AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 4, No. 52. WEEKLY. | NEW YORK, DECEMBER 24, 1881. | $3.00 per Annum. SINGLE COPIES, 6 CENTS

COPYRIGHT, 1881, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

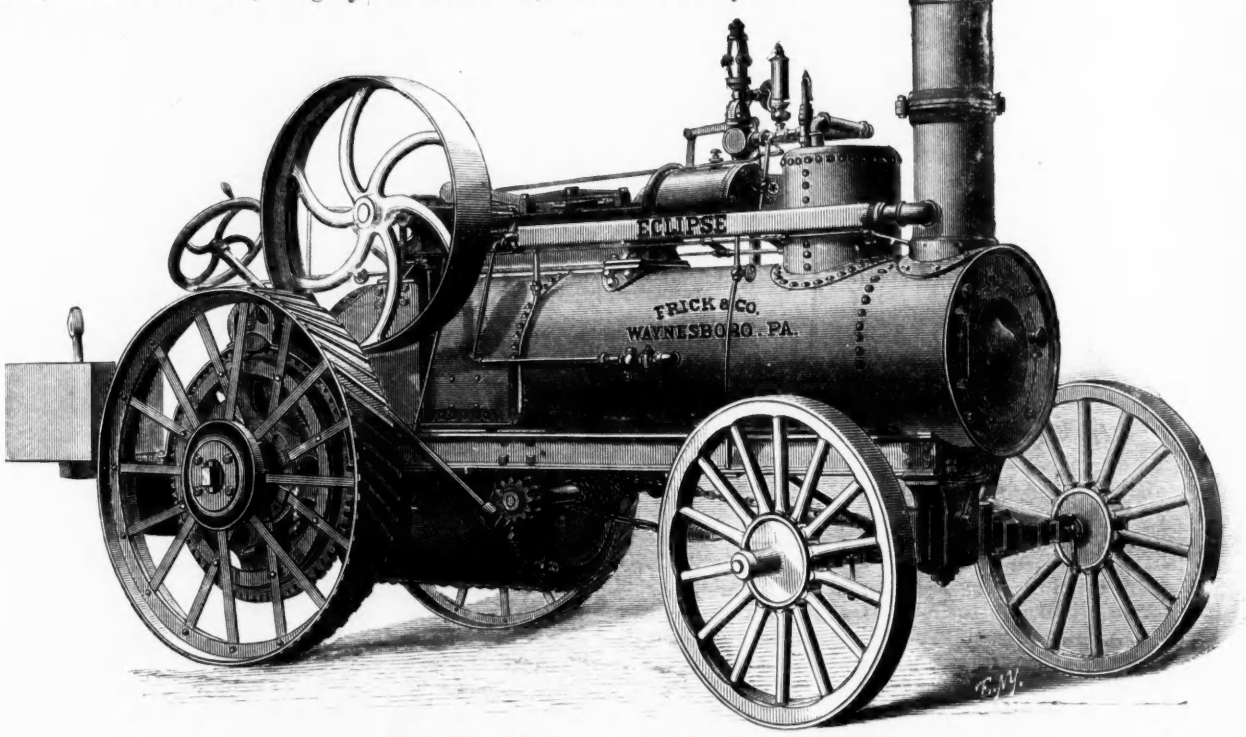
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The "Eclipse" Traction Engine.

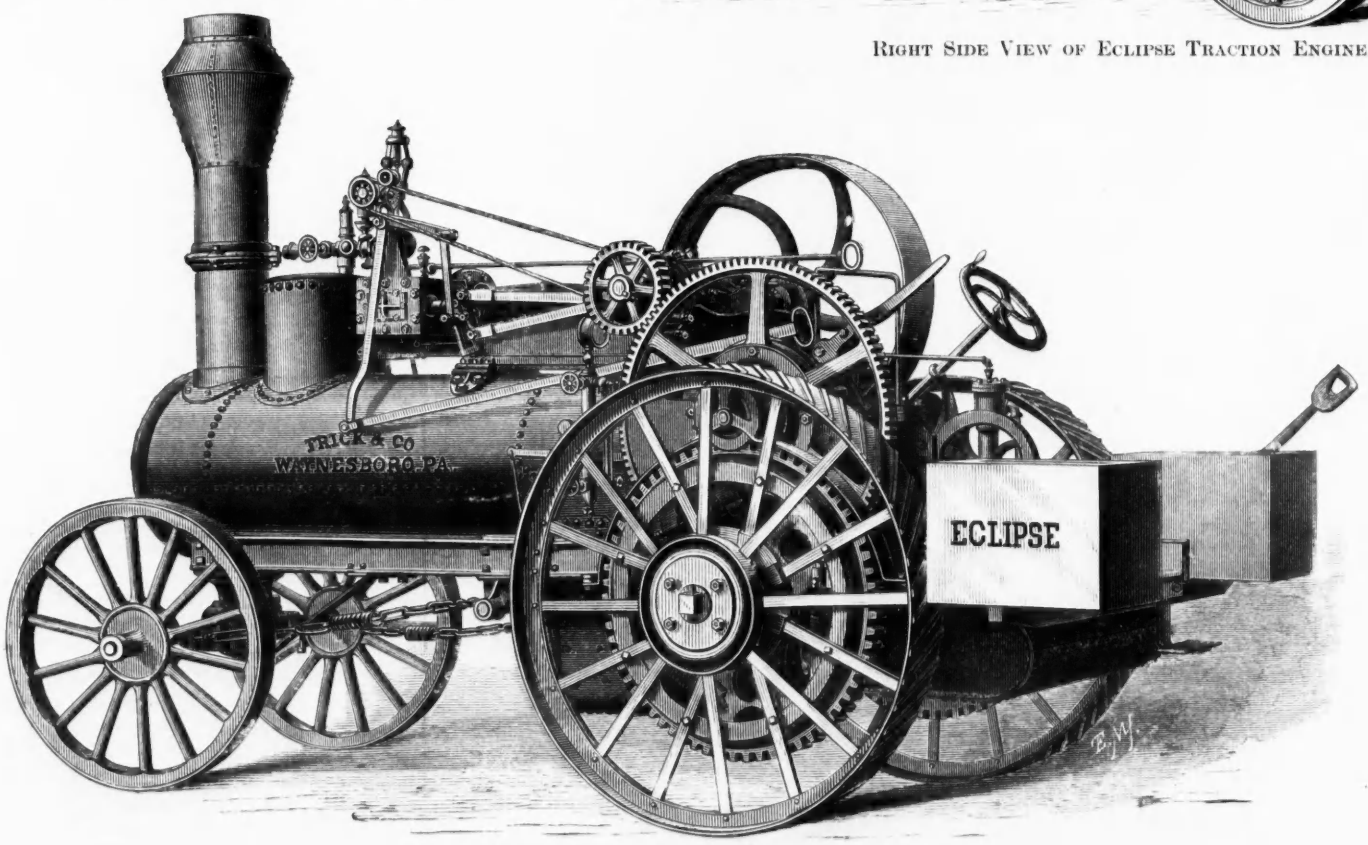
We illustrate this week the traction engine, or road locomotive, known as the "Eclipse," and built by Frick & Co., at their works at Waynesboro, Pa.

This engine has many novel features in its construction, and is in a noticeable degree a departure from the general plan of building traction engines. Particular attention has been paid to so constructing it that no working strains of any kind will be thrown on the boiler, either by the engine or gearing, or in going over rough and uneven roads. It is so arranged that no part of the engine or traction gearing is in any way bolted to the boiler, but is all secured to a separate and independent frame, which carries all the weight and receives all the working strains, thus entirely obviating the difficulty caused by the engine and traction machinery straining and injuring the boiler, and causing the bolts (which are usually tapped into the boiler) to become leaky.

The manner of transmitting the power of the engine to the traction wheels, by means of elastic connections between the gear wheels and traction wheels, relieves the machinery of shocks and consequent injury, and is undoubtedly a decided improvement. Also the plan of carrying the entire weight of engine, boiler and traction machinery on springs, which enables it to be moved over rough roads without risk or injury of any kind, and enables heavy loads to be started with more ease and with less strain on engine and gearing.



RIGHT SIDE VIEW OF ECLIPSE TRACTION ENGINE.



LEFT SIDE VIEW OF ECLIPSE TRACTION ENGINE.

The engravings on this page represent side views, and the one on page 2 an end view of the engine. As will be seen, the main frame of the engine consists of a pair of wrought iron sills, made in the form of channel bars, extending the full length of the engine, from the front truck to a point some distance to the rear of the boiler, where they form a support for the platform for the use of the driver and fireman, and also for the water tank, which is suspended from the under side. These sills, while constituting the main frame, are in nowise bolted, or rigidly attached to the boiler, except at one point, where they are connected by angle irons on each side. There being but this single connection with the sills, it is obvious that the expansion and contraction of the boiler is in no wise affected thereby.

The boiler is supported at other points by a loop, or stirrup strap, which is hung to the sills in the rear near the axle, and by an expansion joint with the front truck. The stirrup or loop carries all the weight of the boiler, and relieves the sheets from all strains caused by carrying it in brackets or plates bolted to the sheets. Metal side plates are riveted to the iron sills on each side of the boiler, and extend vertically therefrom. Each of these plates extends a short distance below the sills, and has a slot or notch at its lower side, which slips over the axle to brace it, and has at its top two levels, the lower one of which carries the bearings for the counter shaft, and the upper one supports the end of the engine frame or bed plate, which carries the crank shaft. This end of the engine frame is formed like a saddle which straddles the rear end of the boiler, and does not come in contact with it, a space of about one inch being left between it and the boiler. There is also the same space between the side plates and boiler, as shown in end view.

The two bearings for the counter shaft are formed in one piece, being connected by a flanged and trough-shaped bar, which serves as a brace to connect the two side plates firmly together, as shown also in end view. The side plates carry the weight of the rear end of the engine frame, crank shaft, fly wheel, pillow blocks and counter shaft, and take all the working strains, thus entirely relieving the boiler of the same.

The engine frame, as will be seen, rests at its back end upon the top of the side plates, as before described, while at its forward, or cylinder end, it rests upon the boiler. It is not rigidly bolted or attached to the boiler at this point, however, but has an expansion joint, to prevent strain occurring between it and the boiler, due to the expansion and contraction of the latter. As shown, in side views, this expansion joint is formed by a casting bolted to the boiler, upon which the engine frame rests, and shouldered bolts pass through longitudinal slots in the flange of the engine frame, so that after the bolts are tightly screwed down the engine frame can slide longitudinally, and permit the expansion and contraction of the boiler without strain.

Particular attention has been paid to the design of the engine bed, the metal being so

distributed as to transmit the strains in a direct line from the cylinder to the two bearings of the pillow blocks. The bed is trough-shaped, and hollowed out in such a way as to catch all the drips of oil, etc., which would otherwise drop on the boiler.

With the ordinary steering gear, as used on traction engines, it is found that the steering chains are not both stretched alike in all positions of the axle; and, furthermore, in running against obstacles it sometimes happens that one front wheel will strike an obstruction and throw the axle around, leaving it in a position which causes the engine to run out of its course, and involves a damaging strain upon the connections and chains. For avoiding this, a metallic or rubber spring is placed in each chain. This, it will be seen, always keeps them stretched in any position of the axle, and if one wheel strikes an obstruction the spring relieves the gears and chains of strain, and also immediately restores the axle to its proper position.

For connecting the boiler to the front axle, a box plate having a curved upper surface, adapted to fit the bottom of the boiler, and slotted lengthwise, is used. This is connected to the boiler by shoulder bolts, which are screwed to the smoke box tight, and allow the boiler to move lengthwise of the plate to compensate for expansion and contraction. This box plate is bolted between the forward ends of the side sills, and is connected with a yoke plate by a vertical bolt, about which the circular upper end of the yoke turns, after the manner of a fifth wheel.

This yoke plate receives a cap plate, which passes through it, and is fulcrumed to it by a bolt. This cap plate has two chambers, one upon each side of its fulcrum, in which are contained springs that bear upon the axle of the front wheels. This axle passes through the cap plate and is provided with two clips, which are rigidly connected with the axle, and serve to hold the cap plate in proper position upon it. The last-named springs support and carry the weight of the front end of the boiler and engine. A brace extends from the bottom of the yoke plate to the sills, for the purpose of resisting the strain involved in running against obstructions with the front wheels. It will thus be seen that no strain is thrown upon the boiler from that cause.

The traction wheels are made entirely of wrought iron, except their hubs, and have a toothed or fluted tire, as shown, for better engagement with the earth. The hub is of large diameter, and within it is arranged a stationary box having a circular periphery, which, with the inner surface of the hub, forms the lubricating joint or bearing of the traction wheel. This box has in its middle a vertical chamber with straight guide walls, within which is contained a smaller box, having a square, horizontal hole through it, which receives the axle. Within this chamber, and beneath the box carrying the axle, are two heavy, spiral steel springs, which form an elastic connection between the load and the axle and wheel. The box is held in the hub of the wheel against slipping out laterally, by a head plate on the outer end of the axle and a corresponding plate at the opposite end, which latter is formed in one piece with the inner box. The two plates are fastened together by bolts. A gear wheel is attached concentrically to the side of the traction wheel, and meshes with the teeth of the driving wheel.

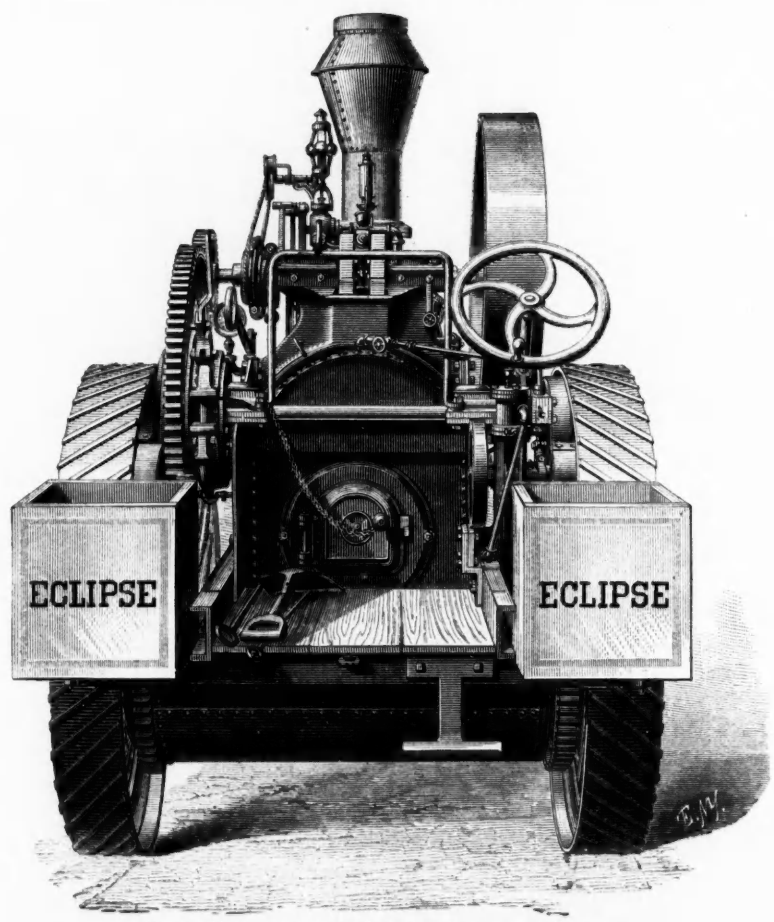
This wheel has a hub that turns on a peripheral bearing of the plate, and is attached to the traction wheel as follows:

To the side of the spokes of the traction wheel is strongly bolted a circular band of metal, provided with suitable lugs, while the arms of the gear wheel are provided with corresponding lugs. These two sets of lugs are connected by a spiral steel spring, the operation of which is as follows:

The gear wheel, it will be seen, must, from the necessity of the case, be immovable, wtih respect to the driving gears, with which it meshes and by which it is driven. The result obtained by the above mentioned arrangement, is a gear wheel which will always be in gear with the driving pinions or wheels, and yet permit the traction wheel to vibrate in right lines as it passes over rough ground, or, in other words, a traction wheel which is not necessarily concentric with its axle. This result is obtained by the springs; for, while the bearing of the gear wheel is always rigid and immovable, the traction wheel vibrates in its plane with a universal spring connection, capable of oscillation throughout the 360 degrees of the circle, and producing varying strains on the springs.

It is this connection of the gear wheel and traction wheel that makes a spring-seated axle possible in the hub of a traction wheel. Without this spring connection the traction wheel could not be an active or propelling wheel, without having its center concentric with its axle, and a constant distance from the center of the gear wheel which drives it. These springs also cause the rotary strain between the gear wheel and traction wheel to be a yielding one, thus entirely relieving all the gearing and the engine of severe shocks and strains in suddenly stopping and starting, or in passing over rough and uneven roads.

The counter shaft is also provided with a compensating gear for taking up the slack in making curves. The arrangement of this is such that there will always be an equal strain



REAR VIEW OF THE ECLIPSE TRACTION ENGINE.

on the traction wheels while curving or going straight, thus relieving the machinery of unequal strain, making it work more steadily and with less liability to wear and tear than if made simply with pawl and ratchet, in which case the inside traction wheel, in making curves, must do all the work, consequently throwing all the strain on that wheel and the gearing on that side. With the compensating gear, as described, the slack and gain is divided, making the working and propelling force exactly the same on both traction wheels, whether on a turn or in going in a straight line. This brings about steady motion, and consequent durability under all circumstances, while the shock and jar always so unpleasant, and in many instances destructive and absolutely dangerous, are by the means described entirely obviated.

The boiler is made of the best material, and the heating surface is large, so as to admit of making an abundance of steam under the most unfavorable conditions, and reduce the liability to prime on hilly roads or by rapid firing. The crown sheet is inclined toward the rear of the engine, so that it will always be covered with water in going up or down hill. The dome is placed in such a position, that in connection with the improved crown sheet, there is no danger of priming, and the engine is always supplied with dry steam.

The Atlanta Cotton Exposition.

EFFICIENCY AND EXPENSIVENESS OF THE CLEMENT ATTACHMENT.

Editor American Machinist:

One may form a conception of the antiquity of the human race, even since the development of a more civilized condition, by considering the time required for the introduction of a new principle in textile art. Arkwright, in 1768, by the substitution of leather on a top roll, for the touch of a human hand feeding cotton to a spindle, invented the first spinning by power, which increased the productive capacity of each spinner one hundred and thirty times. And fiber has never been spun except by the old hand wheel, or by machinery, involving Arkwright's invention.

In the Exposition are some persons carding, spinning and weaving by hand; within the same enclosure, modern machinery enables each operative to produce 800 times as much; and on finer work, the ratio would fulfill the scriptural prophecy "one shall become a thousand."

Notwithstanding this rapidity of fabrication, unknown in any other industry of civilization, except transportation, the results of machinery producing cloth have touched only a moiety of the human race; scarcely one-fourth of those inhabitants of the world who wear cotton cloth use fabrics made by machinery.

Transportation is now developed to an extent where the surplus products of civilization can be carried to other countries cheaply; and now is the time when the demand is the greatest for improvements in every department of mechanical skill—is so great that success is sure to meet with reward.

In 1836, Bonney & Bush, of Wilmington, Delaware, made what was termed a "Plantation Spinner." It consisted of a small gin from twelve to eighteen inches wide, in front of a card cylinder; at the other side of the card was a doffer feeding 4 or 6 spindles, according to size.

Seed cotton fed into the gin was delivered as yarn upon the bobbin. Hundreds of them were made and sent South, but the *same causes which now exist* stopped their use and manufacture. Diligent search has been made through the South for some of these machines, to be shown at the Atlanta Exposition, as the relic of a curious feature in the cotton manufacture. If this meets the eye of any one who knows the whereabouts of any of these old machines, I trust that they will communicate with the writer.

In 1869 Lewis T. Clements, of Tennessee, patented an "improvement in the machine for ginning and cleaning cotton," which was a method of making seed cotton directly into yarn, avoiding the independent process of packing and the separate branches of cotton manufacture. He died when his machine was constructed, but not perfected. About six years later, F. E. Whitfield, of Mississippi, interested himself in the abandoned machine, made some improvements, and exhibited it as the Clements attachment at the Exhibition at Philadelphia in 1876. At that time the local papers contained many references to this device, as something which would centralize the whole business of cotton-spinning around the fields where it grew, and revolutionize all matters connected with this industry.

The attachment was put on the market in 1876, and there are now in use at fourteen mills a total of forty cards.

The Clements attachment consists, first, of an endless apron for feeding, as in a cotton picker. This conducts the seed cotton to a saw gin, which removes the lint from the seeds. A revolving brush takes the lint from the saws, and delivers it to the card, and on the other side of the card the sliver passes to a head of drawing, which draws the sliver four to one and feeds it into a drawing can. The gin, card, drawing and can motion are fastened to the same frame, and the machine is merely the combination of several machines. There is no adjustment in any part, and no evener to the drawing head.

This process is necessarily confined to coarse yarns, the limits being to furnish sliver for yarns between numbers eight and twenty.

Mr. Whitefield gave the writer every facility to examine the construction and operation of the machine. Forty-six pounds of seed cotton was made into sliver, with the following results:

The weights were taken upon a scale loaned from the exhibit of the Howe Scale Company by their manager, Mr. J. F. Dennis. The scales were tested with standard weights, and their accuracy thus vouched for.

	Pounds.	Percentage.
Trash	1.75	.038
Cotton seeds	30.50	.663
Waste	.25	.006
Sliver	13.50	.293
Total seed cotton,	46.00	1.000

The day was clear and favorable; near the machine the thermometer indicated 71 degrees, and the hygrometer showed a humidity of 70 per cent.

The time was one hour and twenty-three minutes, or at the rate of 33.25 pounds seed cotton, or 9.75 pounds sliver per hour, which is a remarkable rate for carding, being some three times as rapid as such a card would work on single carding in a mill.

The size of the sliver is determined by the rapidity of feeding the seed cotton, which is weighed upon scales, and distributed upon the apron in the same manner as the stock is fed to some kind of cotton pickers and woolen cards.

The card around which these attachments are grouped is the well-known top flat card with Wellman stripper, made by the Bridesburg Manufacturing Co., of Philadelphia.

The gin consists of 64 saws, 7 inches in diameter, with 14 teeth to the inch, revolving 160 revolutions per minute. This gin cleans seed cotton at the rate of $1\frac{1}{8}$ pound per saw per minute, and at a trial of some of the saw gins the average rate was $\frac{1}{3}$ pound per saw per minute; and one source of the advantages claimed for Clements attachment is clearly due to the fact that the cotton is ginned so slowly that the staple of the cotton is uninjured.

The samples of cotton yarn given me were rather uneven, but appeared strong. The most even and smooth sample was spun at the Westminster Mills, in South Carolina, and proved to be number 13; twist, 12 to inch; average strength, 93 pounds. This

would be classed as ordinary by the English standard tables.

It is assumed that the machine will be in a cotton district where the cotton crop as gathered can be stored in barns, and then manufactured by the Clements attachment.

This would meet with the greatest success where there is a demand for coarse cotton goods, which the spinning wheel and hand loom cannot supply, and where the mills are not in the market with such productions.

The cost of the attachment does not compare favorably with that of the plant of mills fully equipped for the manufacture of cotton goods.

The cost of one attachment, including freight, setting up and royalty (with neither building nor motive power) was stated by the exhibitor to be $4,410.

C. J. H. WOODBURY.

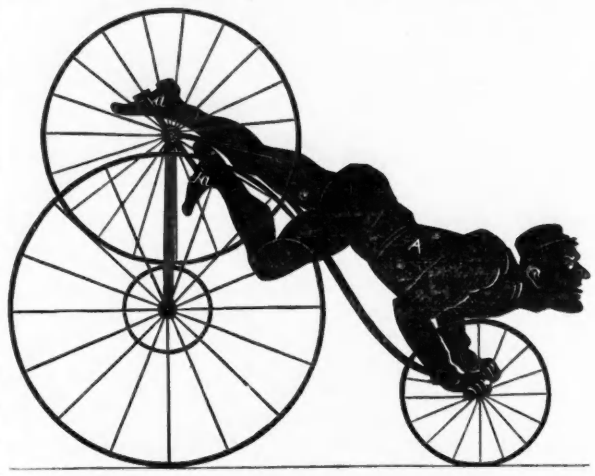
A New Application of the Fontaine Principle.

We are informed that the trials of the Fontaine locomotive upon the Pennsylvania railroad have been completed, and, according to all accounts, they did not equal the sanguine anticipations of the inventor who ascribes the failure of his locomotive to pull a load equal to that of the standard passenger engine, to the *greasy condition of the track* upon the various divisions of the Pennsylvania railroad. We are indebted to our esteemed contemporary, the *Railroad Gazette*, for the following pointed description and illustration of the Fontaine principle, as being capable of other applications than to locomotives. A correspondent of that journal says:

There are a great many mechanics and inventors in the country who have taken much interest in the discussion over the Fontaine engine, and I must say that the way the *Railroad Gazette* has treated the question is most unfair. It is generally known and admitted that most inventors are practical men, who have learned what they know in the shop, and so to speak by the sweat of their brows.

As every practical mechanic will tell you, what a man learns in that way is worth much more to him than the science, with its x + ys, that the college-learned fellows are always talking about. It is not giving a working man either a fair show when he invents anything to take any of these new-fangled sciences, like the conservation of energy, and use them to upset what he has got up with his own ingenuity. I tell *you* there is quite too much of this monopoly business going on, and that the scientific fellows need not think that gravitation, leverage and moments can be used to crush the honest inventor. I tell *you* it is not only in money matters that there are monopolists. There are Vanderbilts and Jay Goulds who think they can make a corner on us practical men by getting all the knowledge of science in their own heads, and then, when a working man takes out a patent, they crush him by showing that his machine don't agree with the laws they have laid down. I tell *you* that if the law of gravitation and the conservation of energy is going to be used to defraud honest inventors, they have got to be changed. There is quite too many such aristocratic notions around—some of which your editor probably got when he was in Europe—especially among colleges and scientific schools. Fortunately, we have a paper that stands up for our rights, and when the *Railroad Gazette* pokes its theories at an invention, like this new locomotive, the other paper comes out bold, and says it is "not concerned with theories," but it wants "practical performance." It is true that report says that the performance of the Fontaine engine on the Pennsylvania road was not a first-rate show, but then everybody knows that the officers of that company have quite too much aristocracy about them to give a practical inventor a chance, and as soon as the engine got there they attacked it with thermodynamics. It is said that they put some of that stuff in the boiler so as to keep it from making steam.

The Detroit *Post and Tribune* is another paper that stands up for practical inventors, and it showed exactly what the true insideness of your attack on the Fontaine engine was. It said that one of your editors "is rumored to own several of the patents on 'Long-legged No. 10,' on the Pennsylvania Railroad, which are a source of gain to him, and if the Fontaine should succeed it would result to his damage." It has been found out since that he does not own a patent on the No. 10, or any other engine on that road, but then that don't make any difference, because he would have owned such patents if he could. There must be some reason for your attack on the Fontaine engine, any way; to write and publish an article because it seems to be true and fair shows that you are not practical.



VELOCIPEDE ON THE FONTAINE PRINCIPLE.

Any way, I'm going to show you that your mule and your theories can't upset the new principle of reinforcing power. You must admit that if the principle is good in locomotives, it will work just as well for a velocipede. I have seen this, and invented and patented a new vehicle of that kind, of which I send you a sketch with this letter [shown in the accompanying engraving] and a copy of what I claim. I am also thinking of applying the principle to your mule, and taking out a patent for the combination.

"*Claims*: I claim as my invention and desire to secure by letters patent the following features:

"1. A velocipede with superimposed friction wheels arranged posteriorly to a man axially inclined.

"2. The reinforcement of the power of the operator, effected by means of the duplex action of his legs and arms; the backward thrust of the former propelling the vehicle by the rotation of the cranks, while his arms are simultaneously pushing it forward, thus doubling the useful effect.

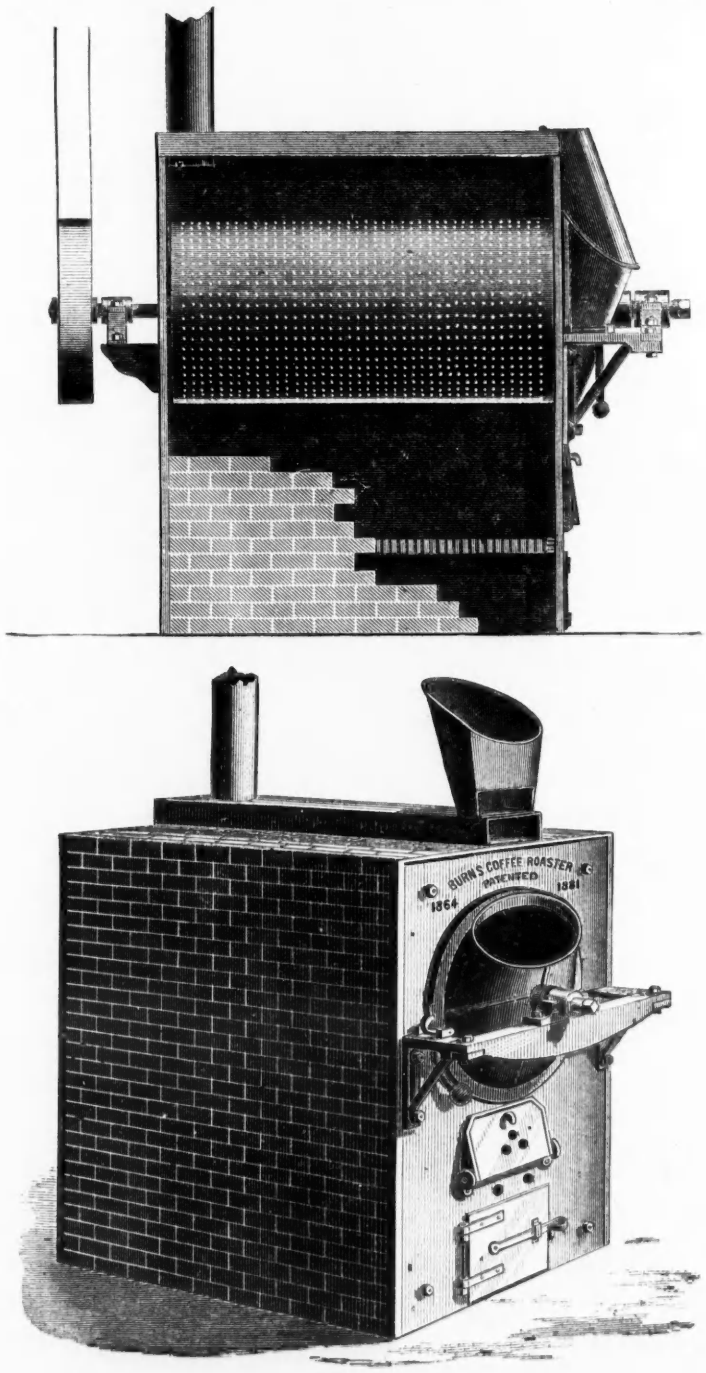
"3. The method of operating a pair of cranks *aa*, by means of another 'crank' *A*, having his heels higher than his head, substantially as described.

X. Y. Z."

P. S.—If you mention this in your paper, say that I'm getting up a stock company, and if any one will furnish a little ready money, they can come in on the ground floor.

Burns' Improved Coffee Roaster.

The accompanying cuts show the latest improvements in machinery adapted to roasting coffee on an extensive scale. A few years ago this line of business employed only the simplest kind of machinery. In fact, the horse might still be living that was used to turn the crude roaster and the mill used to prepare the material, for what has now become the most universal and acceptable beverage of the entire civilized world.



BURNS' IMPROVED COFFEE ROASTER.

With the advance of steam, which is now almost exclusively used as a motor, and the improved appliances for roasting, whereby the coffee is cheaply and acceptably prepared, the old-fashioned methods of household roasting are being superseded, and the custom more and more prevails for consumers to purchase roasted coffee. The business of roasting coffee has increased, therefore, far beyond the very large yearly increase of importations, and machinery to meet the demand has become a necessity.

The principle of this improved roaster consists of cylinders, many of which are seven feet in length. They are filled and discharged at the same end, the opening in the head-plate answering for both purposes, whether it is above or below, as the case may be. This is accomplished by simply turning it over, the shaft forming the axis. The inside of the cylinder is so constructed that when the material enters it is conveyed back to the other end, and is kept in motion from end to end until it is desired to remove it from off the fire, when, on turning the end over, as already described, it will readily discharge into any suitable receptacle.

By the appliance of simple mechanical devices for conveying the material to be roasted, a large quantity can be roasted with only a minimum of labor. One such machine is capable of roasting two tons of coffee per day, and with reasonable appliances one man can take care of several machines.

It is the invention of Mr. Jabez Burns, and is the result of many years of experience in this line. They are manufactured exclusively by Jabez Burns & Sons, 3 Worth St., New York.

The Canal Systems of Europe and America.

It is noticeable that while the interest in the canal system of the United States is at a very low ebb, in Europe—on the Continent—a great deal of activity prevails in the direction of improving old and instituting new systems of canals. Even in Holland, where it might be supposed there was no room for further improvement, the authorities are vigorously pushing the enlargement of old and the building of new canals, while in Belgium, France, Germany and Austria, the subject is receiving serious attention, and in several of those countries gigantic schemes for improving inland navigation are on foot.

As the result of extended investigations made by the Minister of Public Works in France, and which demonstrated that transportation by water would cost only about two-fifths as much as by land, $200,000,000 will be expended in improving inland navigation. This is to be done from a comprehension of the fact that French manufacturers must have cheaper rates of transportation to hold their own against German competition.

In this country the people have come to look upon the canals as mainly useful to hold the railroads in check, while it is said that in Great Britain—and with considerable alarm by the more thoughtful—that the canals are gradually passing into the hands of the railroad corporations.

In a country of great distances like the United States, it will never do to lose sight of the fact that if we are to compete with other countries outside our own territory, cheap transportation is one of the important factors in the problem.

The fact seems to be that Continental Europe is considerably ahead of the rest of the world, and particularly of the United States, in recognizing the importance of cheap transportation to the manufacturer.

The first fair of the New England Manufacturers and Mechanics Institute, which closed in Boston a few weeks ago, was a brilliant success, both financially and mechanically. There were about 1,500 exhibitors, and the display of machinery and manufacturing appliances was one of the best ever made in this country. All the space in their immense new building (the largest permanent structure ever erected in the United States for exhibition purposes) was taken up, and we are informed by the Treasurer, John F. Wood, that over 700 applications for space are already on file for the exhibition of 1882. A copy of their catalogue of the First Annual Exhibition is before us. It is a 336 page pamphlet, and describes almost everything that was exhibited. Persons in any part of the world manufacturing new and useful machines would do well to exhibit them at the next fair of this association.

Details of a New Compressed Air Locomotive.

In the AMERICAN MACHINIST of December 10, 1881, we illustrated and described a new compressed air engine, now running upon the Second Avenue Elevated Railroad, in this city, and promised the details shown by the accompanying engravings.

The four large air reservoirs are shown at *E E E E*, in Fig. 2, the lowest one running the entire length of the engine. This reservoir is supported by the cylinder saddle *D*, as well as the guide yoke, while the other reservoirs are supported by brackets, bolted or riveted to the lower reservoir and frame of the locomotive.

These reservoirs are all connected by pipes, as shown at *j k*, while the small boiler for heating the air is shown at *G*, resting upon top of lower reservoir. From the reservoirs the air passes through the pipe *k* into the bottom of this boiler. A reducing valve *l*, is placed upon the pipe *k*, for reducing the air pressure uniformly, as already described.

The air supply for operating the locomotive is taken from the top of the boiler *G*, and conveyed to the cylinders through the pipe *m*, the supply being regulated by a throttle valve. The two small reservoirs *H H*, are for receiving the air pumped in by the pistons, in coming to a stop at stations.

The cylinder saddle *D*, is made hollow and forms an exhaust chest for the two cylinders, from which extends the exhaust pipe *I*. The hollow saddle is also used as a vacuum chamber when the cylinders are used as air pumps, and draw their air supply from the saddle. A hose connecting with the coupling *S*, opens a communication with the vacuum brakes upon the train.

A check valve *J*, is placed in the exhaust pipe to prevent air from entering the saddle.

The two cylinders are connected by a pipe *p*, through which and the pipe *q*, the compressed air passes to the boiler *G*, thence to the reservoirs *H H*, when the cylinders are used as air pumps and draw their supply from the atmosphere. The wheel *e*, is connected with suitable mechanism for adjusting the cut-off valve, which is shown in Fig. 1, where *A* represents the cylinder, *C* the main slide valve operated by the valve stem and usual link motion previously described. The main features shown in this engraving are those for using the cylinder as an air pump.

The main valve is held down to its seat by a pressure plate or bridge piece *D*, which bears upon the top of the main valve at the sides. The operation is as follows: when the cylinders are used as air pumps, the air pressure within rising above that in the steam chest will lift the valve from its seat and cause the valve to flutter, and pressure to become equalized, as in the plain slide-valve locomotive. In using air to haul a train, the pressure plate is not required, but when the conditions are reversed, as in pumping air, some contrivance is required to hold the valve down. Therefore, such device to answer the desired purpose should act when required, and exert no influence whatever at other times.

To attain this end, the steam-chest cover *H*, has an annular rib or face upon the top, to which is bolted a sheet-steel diaphragm *L*.

This diaphragm is attached by a collar to the pressure plate *G*, so that when air is being used the pressure within the chamber under the diaphragm lifts the pressure plate away from the valve. But when air is pumped the pressure upon the outside of the diaphragm presses the valve closely upon its seat. This pressure may be increased or diminished by means of the screw *K*. In pumping air, the reverse lever is to be placed at mid gear, so that all the ports are closed by the main valve *C*. Air is then drawn in from the exhaust cavity in the saddle through the suction valves *E* in the cylinder heads, and discharged through the valves *F* and pipe *f* into the reservoirs previouly mentioned. The admission of air to or the production of a vacuum in the exhaust cavity of the saddle is controlled by a stop cock within reach of the engineer.

The hose *S* is for connecting with the vacuum chambers under the train.

The cut-off mechanism is shown in Fig. 3, which, with the description already given, will be readily understood.

The reducing valve for the supply pipe to the cylinders, is shown in Fig. 4, where *A* represents a reducing valve having a diaphragm, in principle not unlike ordinary valves for that purpose. The peculiarity of this arrangement consists in its being connected, through the stem *B* and lever *E*, and spring *F*, with the throttle valve *G*.

In moving the throttle lever *H*, as in opening, through the mechanism described, the reducing valve is made to open earlier than it would otherwise do, and in closing the valve it will close with a less pressure than is exerted by the difference in the pressure of air upon the diaphragm and valve seat. The object of this arrangement is to provide means for conveniently lessening the resistance offered to the movement of the diaphragm by the air when the throttle is closed, so that a less pressure of reduced air will serve to close the reducing valve.

Without this arrangement, after the throttle valve is shut off, the air of reduced pressure will not exert a sufficient force upon the diaphragm to close the reducing valve, until the pressure of air in the reduced air tank is higher than, or as high as, the ordinary working pressure, and, therefore, the pressure in the reducing tank is at its highest point when the reducing valve is closed and the engine is at rest.

When the lever is moved to close the throttle, the resistance of the spring will be lessened; while when moved to open the throttle, the spring will be distended, thus increasing the resistance. This resistance may be increased or diminished by means of the thumb nut at *C*. By the aid of this mechanism, the reduced air pressure for working the engine is maintained more uniform than could possibly be done without it.

Fig.1

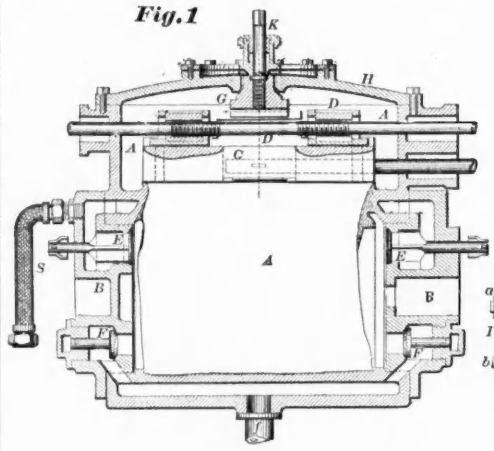


Fig.3

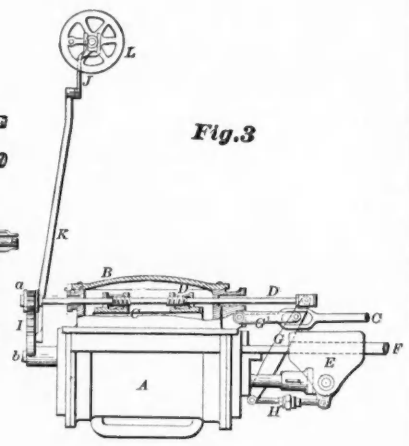


Fig.2

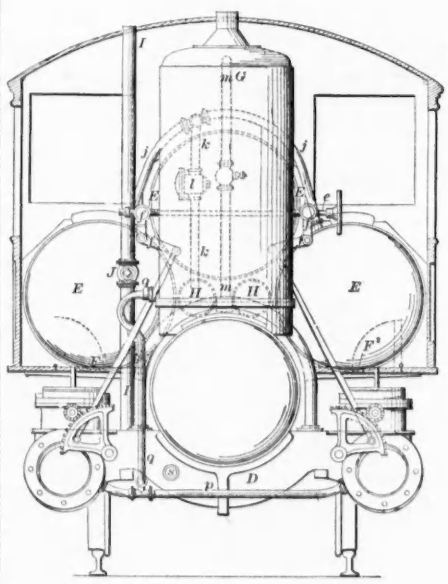
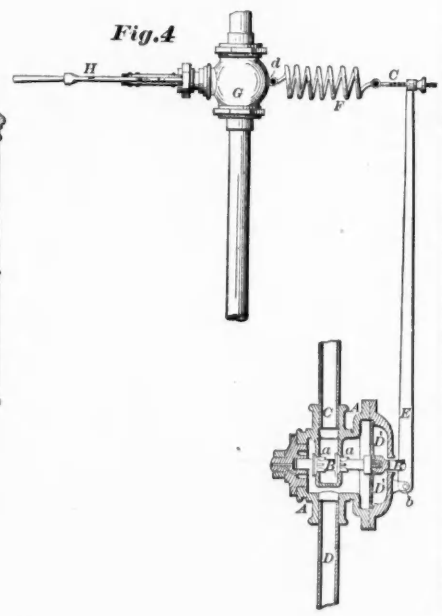


Fig.4



To Keep Machinery from Rusting.

The *English Mechanic* gives the following recipe to keep machinery from rusting. Take one-half ounce of camphor, dissolve in one pound of melted lard; take off the scum and mix as much fine black lead as will give it an iron color. Clean the machinery and smear with the mixture. After twenty-four hours rub clean with a soft linen cloth. It will keep clean for months under ordinary circumstances.

Semi-Annual Meeting of Cotton Manufacturers.

The meeting of the New England Cotton Manufacturers' Association was held in the Institute of Technology, Boston, Wednesday, November 30.

About 200 members were present, and the interest was sustained at both sessions.

President John Kilburn, agent of the Lawrence Manufacturing Co., of Lowell, called the meeting to order. After disposing of certain business matters and the election of new members, the relative merits of mule and frame spinning was the subject of discussion.

George Draper said that half of the cotton goods made in the United States are print cloths woven from No. 28 yarn for warp and No. 36 for filling; and some of the sheeting is made from the same size yarns, so the spinning of these yarns affects a greater range of manufacturing interests than any other sizes.

Previous to 1871, in Fall River, they maintained that they could make No. 28 yarn more successfully on mules than on frames, but they used the old-fashioned taper spindle at that time. When the Sawyer spindle was introduced, it was more successful than the mules for this work, because the expense of additional power required for frame spinning was offset by the use of cheaper labor, the saving of waste, the harder yarn, which wove more uniformly without kinking, and made cloth with a harder surface than mule yarn.

One agent said that the help preferred to weave frame yarn at one cent. a cut cheaper than mule yarn. In another mill the number of breakages, between frame and mule yarn, was as one to four in favor of frame yarn. With mule yarn, spun on small paper tubes in the form of cops, the twist in the yarn can be fixed by surrounding them with steam, but such treatment would injure the wood bobbins with frame yarn, and they are placed in chambers heated for two hours with a steam coil.

All calico print works that make their own cloth, with the exception of the Merrimack, use frame yarn, and the Merrimack used the old throstle frames, which spun even harder yarn than the present ring frames.

On the matter of spinning number 36 filling, it was stated that this size furnished the greatest number of spindles and looms, but not the greatest weight of goods.

Mr. Draper did not think that such filling could be spun satisfactorily on a frame without an evener attachment.

There was a spirited discussion on the use of eveners, some considering that the 8 per cent. variation between the extremes of speed given to the front roll was too much, and increased the evil it was designed to allay. The majority of the speakers were in favor of the use of eveners. One referred to spinning yarn for cotton flannel on frames, as showing how slack twist could be spun on ring frames.

At the Willimantic Linen Company they use the long staple Sea Island cotton, and numbers 45 to 60 were spun on old ring frames before the light spindles were invented. Since then they have spun 80 to 140 on frames, and for their exhibit at the Atlanta Exposition spun 350 on ring frames. In their new mill they have no mules, but spin with the new Rabbeth spindle, without any evener on the frame.

Mr. Richard Garsed, of Philadelphia, saw in England in 1852 a throstle-filling frame, made by Higgins.

It spun number 50 for twelve hours without a break. Evening was accomplished by a differential motion applied to the spindle, but there were mechanical difficulties connected with the machine which prevented its practical adoption.

Edward Atkinson considered it well established that filling yarn was well spun both with and without an evener; but that too much attention had been given to new devices, to the neglect of essential features in spinning, as the condition of the atmosphere, the covering of the top rolls, the irregularity of the weights on the rolls, and the tension of the bands. Any one of these features makes more differences in the yarn than the questions involved in the use of the evener. The improved construction of a frame must be in the direction of simplicity, so that the efficiency of the frame can be increased by enabling one operative to manage a greater number of spindles.

This discussion was quite spirited, and while all agreed in the preference for frames for print goods, there were many differences in matters of technical detail, to which the limits of this abstract permit no allusion.

Those who had attended the Atlanta Exposition were enthusiastic in their descriptions of its extent, and hopeful in their anticipation of its results upon the culture of cotton, as well as the improvement of everything tending to advance the material interests of the South.

At the South cotton is valued on account of its cleanly appearance, and little reference is paid to tenacity or length of staple. It was considered that the new varieties of cotton, Ozier's Silk and Jones' Improved, which have a staple midway in length between Upland and Sea Island, place the fine mills of the North on a par with those of England, which use the long Egyptian cotton. One speaker considered that the introduction of these varieties advanced the cotton interests twenty years, both in regard to its culture and manufacture.

The debate relative to the condition of cotton was in contrast to remarks upon that subject at previous meetings, as every one seemed to be of the opinion that the causes for its improvement were becoming patent, and those who had met the Southern planters realized that the cotton spinners were largely responsible, because they had not made their wants known to the planter.

Relative to the comparative merits of saw and roller gins, Colonel W. E. Barrows had half of a lot of Jones' Improved cotton

ginned on a saw gin, and the remainder on a roller gin; practical spinners valued the roller-ginned cotton two grades higher than the other portion, which was identical except in the ginning. On spinning this cotton it was found that there was 25 per cent. more waste from the saw-ginned cotton than from the roller-ginned cotton.

One farmer had raised a lot of Ozier's Silk cotton, and, uninformed as to all its merits, was content with the increased yield, and sold his crop at ten cents per pound. A Northern manufacturer offered him sixteen cents a pound for such cotton, if ginned on a roller gin. Such is the value of the proper mechanical appliances, coupled with a knowledge of the resources of a market.

It has been assumed that compression injured cotton fiber, and several members are now making careful experiments to determine the effects of compression.

If the result shows nothing against compression, there will be a great demand for the Dederick bale, on account of the saving in freight. Mr. Dumont has made some preliminary experiments between the use of "country" and the ordinary compressed bales, and the results thus far have been in favor of compression; but he is beginning an exhaustive trial, running one half of his mill on cotton directly from the gin, and the other half on the most densely-compressed cotton of that grade. As he is a trained observer, having once been connected with the United States Coast Survey, and has every facility for learning the truth at his mill, his results are looked for with an interest commensurate with their importance.

The Willimantic Company use Sea Island Cotton, which is merely tamped in bags, weighing only about ten pounds to the cubic foot; the freight is excessive, and they are trying this cotton packed in a Dederick press to 45 pounds per cubic foot, with favorable results thus far.

If compression injured cotton, it could never survive the ordinary processes of manufacture, as it is there subjected to more intense pressures than could be applied by any method of packing.

Nathaniel Hill, M. E., of Lowell, exhibited models showing the solution of the more difficult problems of belting, in transmitting power between shafts lying in different planes, with belts so arranged that they would not run off when the motion of the engine is reversed. He also showed his graphical method of ascertaining the proper width of belts for various arcs of contact and coefficients of friction between belt and pulley.

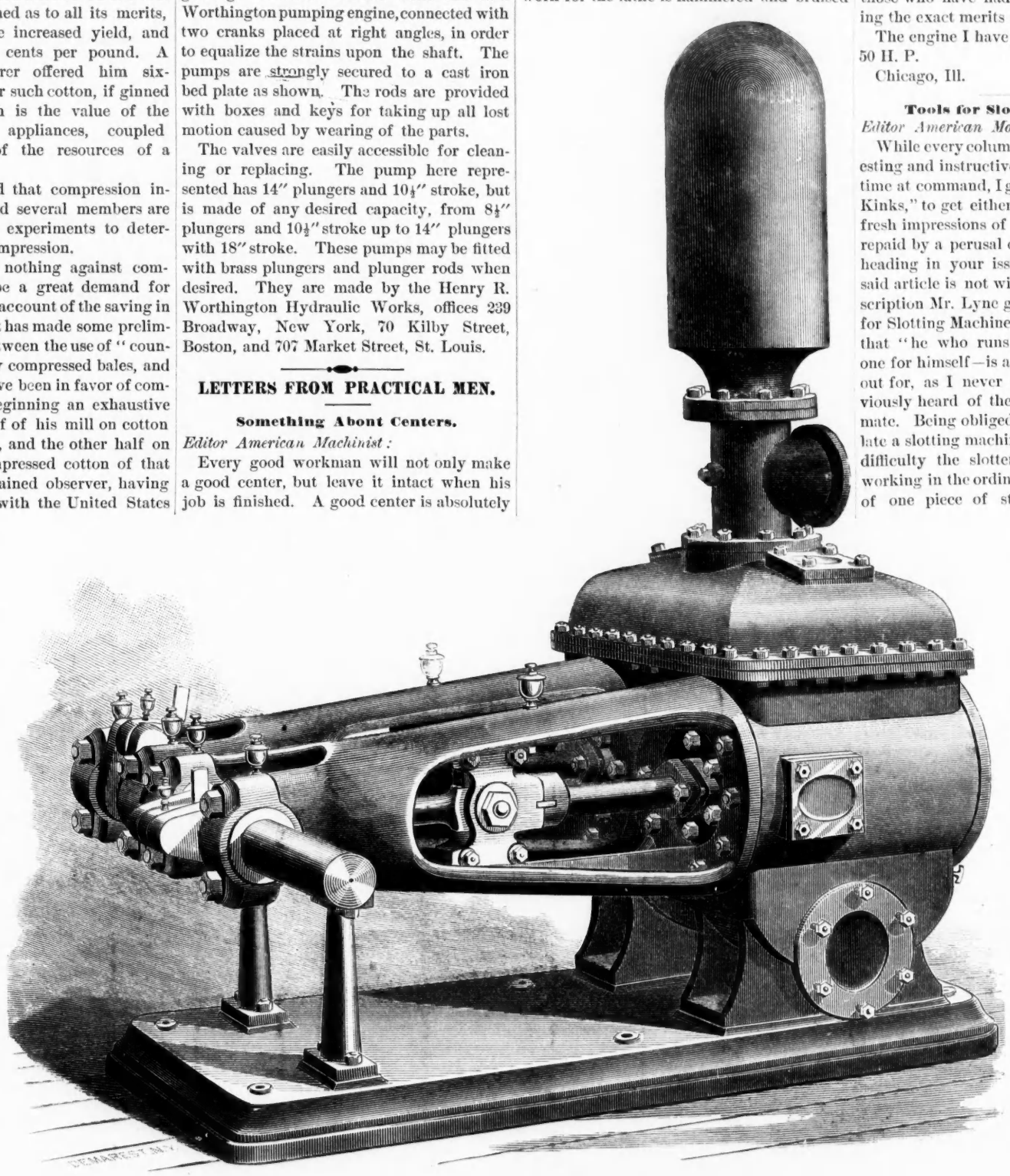
Mr. Nickerson called attention to the excess of weight in iron ties for cotton bales, and trusted that the Cotton Exchanges and this Association would take a stand against the imposition of so much iron upon them at the price of cotton, when the bale hoops could be as efficiently secured by the use of ties made of number eight Bessemer steel wire.

The meeting was spirited, and every moment was occupied by speakers in discussing the subject before them. The members appreciate the advantages of a free interchange of experience and opinions; and seemed filled with that enthusiasm which is the foundation of all success.

The Worthington Power Pump.

In factories driven by water power, it would be an extra expense, and often a great inconvenience, to put in a boiler and steam pump for raising water. The illustration presented herewith represents a power pump intended to be driven either by a belt or gearing. It consists of the water end of a Worthington pumping engine, connected with two cranks placed at right angles, in order to equalize the strains upon the shaft. The pumps are strongly secured to a cast iron bed plate as shown. The rods are provided with boxes and keys for taking up all lost motion caused by wearing of the parts.

The valves are easily accessible for cleaning or replacing. The pump here represented has 14″ plungers and 10½″ stroke, but is made of any desired capacity, from 8½″ plungers and 10½″ stroke up to 14″ plungers with 18″ stroke. These pumps may be fitted with brass plungers and plunger rods when desired. They are made by the Henry R. Worthington Hydraulic Works, offices 239 Broadway, New York, 70 Kilby Street, Boston, and 707 Market Street, St. Louis.



THE WORTHINGTON POWER PUMP

LETTERS FROM PRACTICAL MEN.

Something Abont Centers.

Editor American Machinist:

Every good workman will not only make a good center, but leave it intact when his job is finished. A good center is absolutely essential to good work. Centering machines are good things, but we doubt if they always make the best of centers, for the reason that the ends of the piece centered are not held in perfect line. Unless they are held true, one center may wear to one side and the other to the other side; so that the more the piece is turned, the more the ends will be untrue with each other. To make good centers, the only sure way is, to use a reamer of correct angle, have it sharp, have it run true, and have one end of the work supported on a center which stands true with the revolving reamer; in the meantime turning the work on the dead center. Then, if the working centers do not bottom, and your work is trued up, (which is the first thing to begin with), and if there is solid stock on all sides of each center, and your live center runs true, you can depend upon your work being true.

There is much said now-a-days about "ample wearing surfaces," which is all correct. As a rule, centers should have ample wearing surfaces. As a rule, they are not large enough. As a rule, lathe hands do not take pains enough with the lathe centers, and especially the live center.

With many lathes the only way to have the live center run perfectly true, is to turn it up every time it is removed. This is a "bother," and many will neglect it, but it is the only sure way. The dead center always has a tendency to wear oval on account of the thrust of the turning tool, so a lathe hand needs to *look to his centers* carefully. When work for the lathe is hammered and bruised in straightening it, and these bruises are turned out, the work not only requires more turning to get it true, but the centers may be thrown out of truth. Sometimes small chips may become embedded in one side of centers, and so throw them out of truth. Sometimes a flaw on one side or a hard spot may affect their truth.

Bernardston, Mass. H N.

Overhead Direct-Connected Engines.

Editor American Machinist:

I am anxious to hear from some of our practical engineers and machinists relating to the use of steam engines by direct application.

The first shop in which I worked was run by an 18 H. P. engine (upright), directly connected to the line shaft; in other words, the line shaft was coupled to the engine shaft by a flange coupling. Since that time I have not met a similar situation of engine, and therefore have not been able to secure satisfactory data relating to that mode of application.

What I wish to learn is, why it is not practical if such be the case.

I can readily conclude that our modern beautiful steam engine would lose in dignity from being set up on end and made to turn a crank overhead; but, aside from all prejudices, it does not occur to me that there are any serious objections where one wishes to economize space and cost of belting.

I shall indeed be pleased to hear from those who have had opportunities of learning the exact merits of the case.

The engine I have in mind would be about 50 H. P.

Chicago, Ill. C. C. HILL.

Tools for Slotting Machines.

Editor American Machinist:

While every column of your journal is interesting and instructive, yet, when I have little time at command, I generally look for "Shop Kinks," to get either new practical ideas or fresh impressions of old ones, and was well repaid by a perusal of the article under that heading in your issue of 3d inst., though said article is not without a *kink*. The description Mr. Lyne gives of "A Useful Tool for Slotting Machines"—so minute and lucid that "he who runs may read," and make one for himself—is a thing I was on the lookout for, as I never saw one, but had previously heard of the invention from a shopmate. Being obliged occasionally to manipulate a slotting machine, I know a little of the difficulty the slotter has to contend with, working in the ordinary way with tools made of one piece of steel. He is taking his finishing cut, and, may be, congratulating himself on a nice, clean job as the result, when suddenly, owing to its pressure against the work on return stroke, the tool loses its keen edge and he his temper, for, after fixing and grinding the tool, he has to re-set it—an operation seldom or never accomplished satisfactorily, but always entailing considerable loss of time—and what should have been a finished job has no finish except a negative blessing. For such troubles, the tool so well illustrated and described, promises to be the grand panacea wherever it can be used. So far as I can see it requires a deal of room. It would pay every slotter, however, to have one for such plain work as it can get at, but its big jaws would be eternally in the way, getting into and around corners. It is rather expensive to get up, and then will not do everything, which, with the bosses means, "it won't pay," which, I think, is one reason why this tool is not more generally used. It is still practically unknown, I believe, in some of the leading shops of New York.

With reference to the *kink* alluded to above, Mr. Lyne says: "In feeding a tool in one direction the work is moved ahead while the tool is at its highest position, but while feeding in the opposite direction (the italics are mine) *the work is moved ahead while the tool is at its lowest position.*" The slotting machine must be of very primitive design that feeds only in one direction, while the tool is at its highest position; for it is just as easy to make a slotting machine feed in either direction, at the right time, as to make shaper or planer do it, and all the slotting machines I have had anything to do with are so constructed. As a matter of fact, I believe all tools of this class are at present (however this may have been in their earlier days) arranged so as to feed just previous to the commencement of the cut.

Brooklyn, N. Y. ARTISAN.

Inaccuracy in High Speed Indication.

Editor American Machinist:

I wish to call attention to an incongruity in the indicator cards, illustrated in your paper of April 16th and Nov. 5th, of the present year. It was noticed by many of your readers, that in April 16th the card Fig. 3, was shorter than Fig. 1; also in Nov. 5th, the card marked 600 rev. was shorter than the one marked 400 rev., in about the same proportion. This was attributed by some to the circumstance of the drum of the indicator receiving less motion than in the other cards.

I wish to show that all cards, in each issue, were taken with the same leverage, and that if the drum did not move the same amount, it was because it was checked at one end of its motion, and not at the other. If the short cards be concluded, according to my view, see dotted line Fig. 3, the remainder would be nearly a straight line, and it is possible that the straight part was omitted by the one who took the cards, or by the engraver by mistake, as it might appear to be a part of the atmospheric line?

The manner in which I propose to show this, is by diagrams, the same as I always use in working on valve motions for single valve engines, and is as follows: Taking the cards Figs. 1 and 3, in April 16th, for example: Carefully copy the card, together with its atmospheric line *A B*, Fig. 1. Erect perpendiculars at *A* and *B*; bisect the line *A B* at *C*, and with *C* as center, and with the radius *C A*, describe a circle. Now, mark on the card the point of cut-off *D*, of release *E*, and compression *F*, as near as can be ascertained. Draw lines through these points, perpendicular to *A* and *B*, and extend them to the circumference of the circle, as *I G*, *J H* and *F K*. Draw *A I* and *J K*. These lines will be parallel, unless the curve is vicious in its formation.

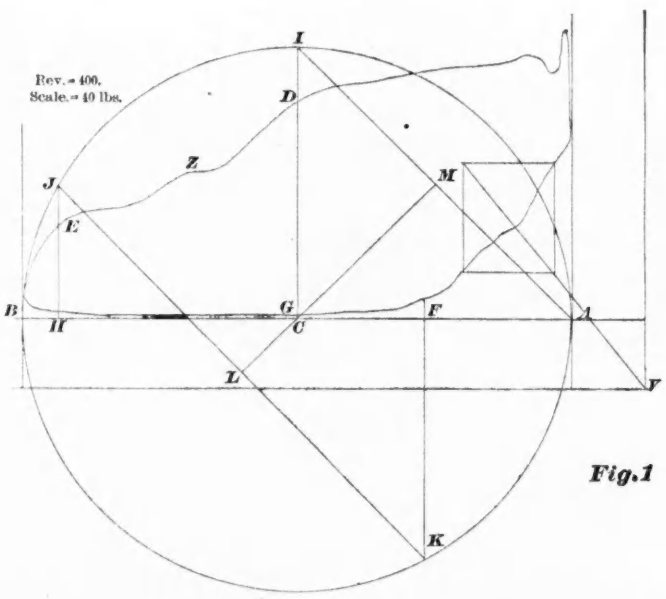


Fig.1

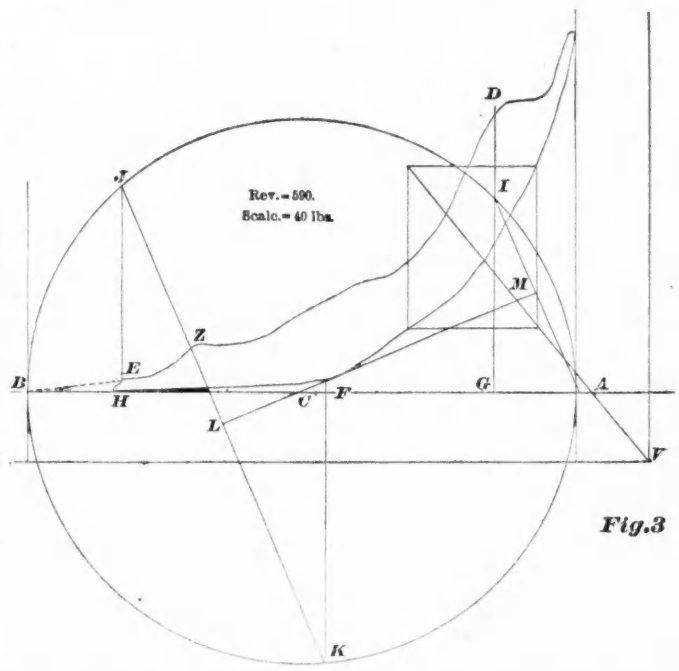


Fig.3

It is evident that if one of these points cannot be determined, and the others can, we may partly reverse this process and obtain the point desired. If there was lead, the point *A*, of the line *A I*, would be below the line *A B*, while, if the admission was late, this point would be above it. Neither appears to have been the case in Fig. 1, but in Fig. 3 the admission may have been late, for reasons well understood by those familiar with the swinging eccentric or link motion.

Now for the application: Taking card No. 1, and submitting it to this test, we find the point of cut-off at *D*, or relatively to the piston's motion at *G*, of release at *E* or *H*, and of compression at *F*; that the lines *A I* and *J K* are parallel, and the curve is not vicious.

We may ascertain the clearance by the well-known rule represented, the scale of the spring giving the position of the vacuum line. This shows a clearance distance on this card of about $\frac{3}{8}$" or 12 per cent. Analyzing in the same way, Fig. 3 shows something radically wrong:

First, locating the clearance line, as in Fig. 1, we find the distance about $\frac{3}{8}$", the same as before. But the card shown is $2\frac{1}{2}$" long, instead of 3", as before; hence the clearance is 15 per cent.; conditions impossible in the same engine, with the same valve. Now, assuming the cards were the same length, but Fig. 3 only partly shown, we find the clearance correct, also the diagram comes out correct, which it would not do before.

We can see by the lines *C M* and *C L* what the proportions of the valve must be to secure this result, and they will correspond in Figs. 1 and 3, if Fig. 3 is corrected, as indicated.

This shows very positively that the card (Fig. 3) should extend to *B*, instead of stopping at *H*, as it does in the cut, and that the point of release is at *E*, instead of at *Z*. The fall at *Z* is due to a vibration of the indicator, and is the same at the same point on all the cards. The expansion curve would, if the steam had not been released before, fall just to the atmospheric line at *B*.

These cards show splendid engine performance, aside from the speed, and really show the capacity of single valve movements. Fig. 3 having a cut-off at one-eighth stroke, shows a result which could be bettered by few automatic engines, however elaborate the valve gear.

F. R. W.

Syracuse, N. Y.

Strength and Elasticity of Floor Beams.

Editor American Machinist:

I wish to reply to the criticisms of Mr. Augustus Schwaab, of Savannah, Georgia, in No. 50, page 6, of AMERICAN MACHINIST.

He claims that the moduli of strength and elasticity used by me are larger than those constants given by the best authorities, although he does not cite the names of the authorities who support his statement. As your correspondent takes exception to the results of my personal experiments and experience on the subject, I will establish the accuracy of my data by quoting the values given by others.

Prof. R. H. Thurston read a paper on the Strength of Yellow Pine, before the American Association for the Advancement of Science, at the meeting held in August, 1880.

For old and thoroughly-seasoned Southern pine, which meets the case of mill beams, he gives:

Modulus of rupture.	Modulus of elasticity.
13,850.	2,178,000.
13,710.	1,949,000.
14,780.	2,193,000.
Average, 14,113.	2,106,000.

In the same paper, Prof. Thurston considers that from one-third to one-half the breaking load $E = 2{,}098{,}000$.

Haswell, in his Engineers' and Mechanics' Pocket Book, page 449, gives substantially the same quantity for Southern Pine, $E = 2{,}100{,}000$.

Hatfield, in Transverse Strains, page 530, gives for the mean values of Southern Pine $R = 850 \times 18 = 15{,}300$. $E = 5{,}900 \times 232 = 2{,}548{,}000$.

Comparing these authorities with my own conclusions, for sound well-seasoned Southern Pine, $R = 12{,}960$; $E = 2{,}000{,}000$, it is evident that my data are certainly less, and on the safe side.

As your correspondent does not mention my data on spruce, there is nothing to be said on that wood.

If he had carefully read the paper which he criticizes, he would have perceived that the table referred to storehouse floors, and not to the support of machinery in operation.

In floors sustaining machinery, the allowable deflection is the limit upon which the computations should be based.

In the text of my paper, the reason is given in detail, for the benefit of younger engineers.

For the problem which your correspondent gives, he should have used formula (21)

$$h = \sqrt[3]{\frac{270\ w\ s\ l^4}{E\ b\ d.}}.$$

Assuming that he wishes the beams twice as high as they are broad, this reduces to

$$h = \sqrt[4]{\frac{540\ w\ s\ l^4}{E\ d}}.$$

The data are: $w = 50$ pounds; $s = 8$ feet; $l = 21$ feet; $E = 2{,}000{,}000$ pounds; $d = \frac{1}{16}$ span $= .63$ inch; then $h = 13.51$ inches, and the size beam used would be 7×14 inches.

The limit of deflection is clearly stated, near the top of column second, page 3, to be .075 inches per 8 feet, say $\frac{1}{1200}$ span. For 25 feet beams, the same curvature is about .75 inches $= \frac{1}{400}$ span. In the middle of column third, instead of $\frac{1}{1200}$ of an inch, read $\frac{1}{1200}$ of each cord of 8 feet. Your stenographer was very accurate, his misunderstanding of "inch" for "each" being the only error in his abstract.

Among the data at the head of the formulæ *a* should be *u*; and formula [7]

$$w^1 = \frac{4\ R\ h^2 - 3\ u\ f\ l^2}{12\ f\ l^2}$$

Boston, Mass. C. J. H. WOODBURY.

Fig.1 *Fig.2*

Device for Taking up Lost Motion on a Lathe Screw.

Editor American Machinist:

I have been much interested in reading in your paper various articles on tool posts and carriages, but there is one thing I have never seen mentioned, nor did I ever see it on any tool I have used; that is, some simple device to take up the lost motion resulting from the wear of the nut and screw.

When the screw becomes loose in the nut, the tool is either drawn into the work or crowded away from it; and, to avoid the risk, the gib is screwed up tightly, which results in the wearing of both nut and screw still faster.

There may be somewhere a device of the kind mentioned; but, having so far failed to see or hear of one, I submit for consideration the following plans, either of which I think would accomplish the purpose: Fig. 1 is the first plan, in which *A* is the nut, *B* the screw for securing it to the carriage, and *C* a screw for closing the nut (which is cut open on one side for the purpose) on to the screw to compensate for wear.

This closing screw can be readily got at with a screw driver, and the arrangement needs no explanation.

In the second plan, shown in Fig. 2, *A* is the nut, *B* is a gib, threaded same as the nut, and *C* is the screw for securing the nut to the carriage. This screw is hollow, and the inside is threaded to receive the screw *D* for tightening the gib *B*.

CHIP.

Buffalo, N. Y.

Shop Wrinkles.

Editor American Machinist:

Among the many simple shop wrinkles which it is possible a few mechanics have not tried, may I relate to your readers a little incident in my shop experience "before the war?"

I found myself brought to the necessity of devising means whereby the two edges of a sheet metal plate could be beveled parallel with each other, to fit accurately in an undercut seat made by a bevel cutter, and at the same time the half-circle end needed to be beveled so as to fit the seat at the bottom of the cutting.

This of course involved the half-circle end being exactly central with the edges. After canvassing the ordinary methods of finding the center, I hit upon the following plan for doing it with a cutter of suitable bevel, running on a mandrel projecting from the live spindle of a lathe. On the cross slide, which was worked by a lever, I pivoted near one end a parallel piece of the same width of the plates, requiring to be beveled upon the top of the slide.

The slide had already been prepared for the operation, by having an upward projecting rib or shoulder running its entire length. The parallel piece, on which the plates were to rest, having had a hole of suitable dimensions made through it vertically, at such a distance from the end as permitted finishing the end from the hole as a center, to the same arc to which the end of the plate was to be milled on the full side of the bevel, and the edges being made precisely equidistant from the hole, the parallel piece being left wider than required in its finished state, until after the hole was made, and brought to the proper width from the hole to insure this.

I then clamped it upon the top of the slide with one edge parallel with, and resting firmly against, the upwardly projecting rib or shoulder on the slide, and with a short-lipped drill, the body of which exactly fitted the hole in the parallel piece, I drilled into the slide, a short distance, a hole of such size as permitted me to use for continuation a sufficiently smaller drill to allow tapping without disturbing the walls of the upper part of the hole.

Now, it will be obvious that with the hole in the slide, enough smaller than that in the parallel piece to admit of a good shoulder on the screw which formed the pivot, and with the holes concentric and screw well fitted, I had an arrangement which could be taken apart any number of times, with no chance for growling because it "did not come twice alike."

Having the pivot screw fitted, I next put a pin in the right hand edge of the slide, and in the bed on which the slide worked I drilled an upright hole at such a point that with a pin standing in it, when the pin in the slide came in contact as the slide was

carried forward, the center of the pivot screw would be precisely opposite the center of the milling cutter.

Now, having reconstructed the old arrangement of 185– "on paper," let us mill a plate. With the cutter running backwards, and the plate to be beveled firmly secured to the top of the parallel piece, with a screw and clamp holding the parallel piece against the rib, with the circular or pivoted end toward us, it will be seen that by pushing the slide from us the cutter will commence cutting at what would be the front right-hand corner, if we were to hold the plate in position to push into its seat.

The cutting will, of course, continue in a right line until the pins coming in contact prevent further motion of the slide, then, holding the slide firmly up, by taking hold of the long end of the pivoted parallel piece, and bringing it around gradually toward us, it will be seen that the half-circle end will be beveled and when the parallel piece has made a half revolution on the axial screw stud, its other edge will be resting against the rib.

If we now remove the pin and push the slide forward until the other edge of the plate is beveled, will any argument be necessary to prove that the desired end was gained?

S. W. GOODYEAR.

Waterbury, Conn.

Principles Involved in Screw Propulsion.

Editor American Machinist:

Your correspondent, John F. Allen, in the December 10th issue of the AMERICAN MACHINIST, judging by his criticism of my paper on "Screw Propulsion," apparently looks upon me as a heretic, who should be scoffed at rather than listened to. His view that previously-acquired velocity of the water is *not* a disadvantage to its further reaction upon the propelling instrument, seems to me erroneous, from the fact that this reaction depends upon the quantity of water passing through the propeller in a given time, multiplied by the velocity impressed upon that water by the propeller.

I contend that I made no mistake in basing my calculations upon the pitch of the screw, instead of the speed of the ship, for the reason that the number of feet of water acted upon is to be found by multiplying the area of the screw disc by the velocity of the water passing through it. If Mr. Allen takes the speed of the ship for his basis of calculation, instead of the speed of the ship, *plus* the slip of the wheel (which, taken together, would nearly equal the pitch), he leaves the velocity of the slip out of the account altogether.

I have made no claim to discovering a saving of power in negative slip, my claim being based upon a saving of positive slip. I would remind Mr. Allen that Froude's experiments in the English navy showed a loss of about fifty per cent. between the thrust of the screw (in pounds) and the strain upon the tow lines (also in pounds) to produce the same speed upon the same vessels. I will further add that I did not offer Mr. Emery's letter as advocating a saving of power.

I will give Mr. Allen a problem. He makes his screw utilize in thrust upon the boat 85 per cent. of the power of his engines. If the boat were *towed* at the same speed, Froude's results would show the power applied to the tow line to be much less than the power that would need to be applied to the screw of the same vessel, when self-propelled, to secure the same speed. What causes this loss of power but the suction, diminishing the pressure of the water against the stern of the ship?

Again, Mr. Allen makes the slip of the screw 14 per cent. A great number of experiments in England have proven that the skin friction of the hull consumes more than one-half the power driving the vessel, by the creation of a following current in which the screw acts, as ordinarily applied. If Mr. Allen had added the velocity of the following current to his 14 per cent. of slip, and computed his engine power upon that basis, he would have discovered that his engine power thus computed would have amounted to perhaps double the power that he had actually applied to the wheel. My experiments bear out the deduction that the velocity impressed upon the water by the propeller is much less than has been heretofore supposed, owing to the constant velocity explained in my paper.

If Mr. Allen will give the foregoing considerations their proper weight, he will then easily apprehend the economy of my system of screw propulsion through the fact that more water is acted upon by the screw, accompanied by a smaller percentage and velocity of slip, and resulting in a lifting thrust and less retardation from the suction of the screw upon the stern lines of the hull.

I am aware that the idea of an inclined shaft is not new. Proportioning the inclination, area and pitch of the screw, as a basis of economical results, is new. Without such proportioning, mere inclination of shaft must result in loss of economy.

New York. JOHN B. ROOT.

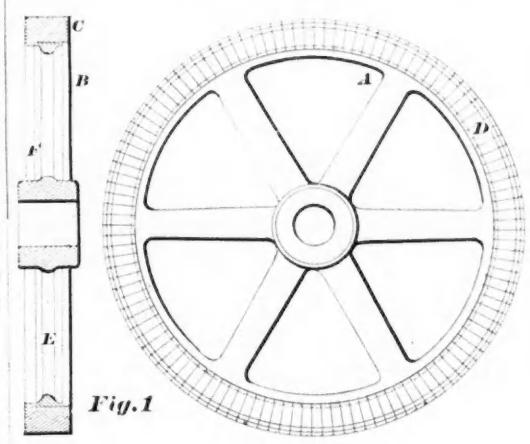


Fig. 1

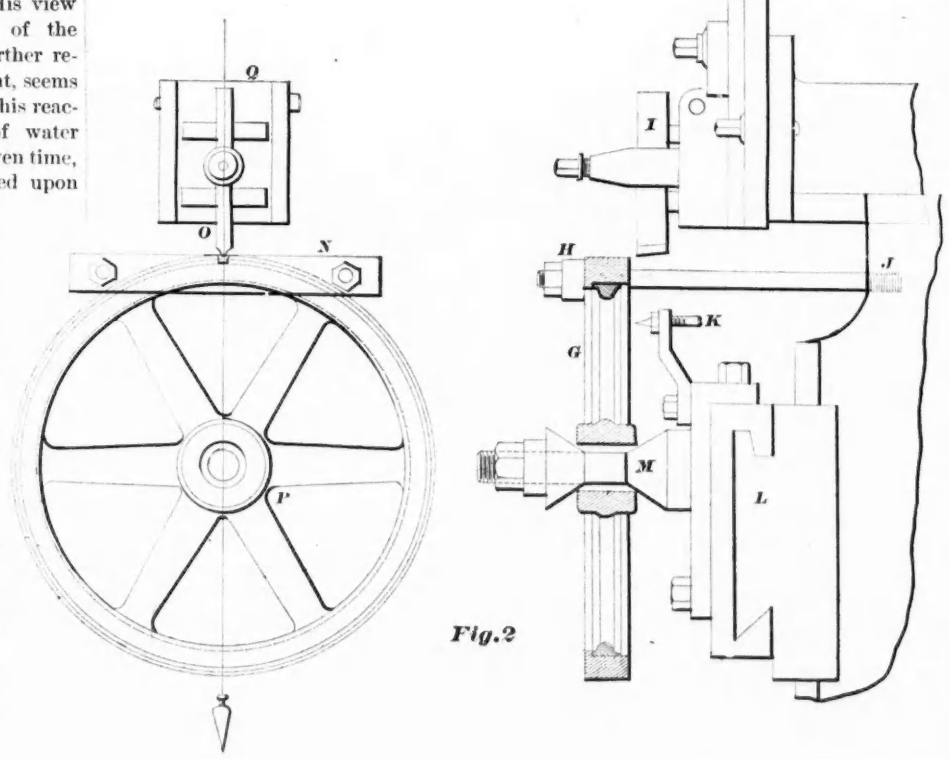


Fig. 2

Shop Kinks.

No. 24.

BY L. F. LYNE.

WRINKLES IN GEARING.

On a certain occasion I was required to build an axle lathe. The castings were all satisfactory except the wheels for the back gearing, which, instead of being made blank for cutting, were cast with the teeth in them. It does not require a very good mechanic to realize how beautifully the back gear of a lathe would run with cast gearing. Practically this means that no two teeth of the gears are of equal pitch. As soon as the gears are safely delivered in the machine shop, some one with a hammer, or other heavy weight, breaks out a number of the teeth. It is well understood by machinists that in doing a job upon a machine or tool, for which the workman is to be held responsible, and, furthermore, the same is to be used in the shop, where it will be subjected to the severest criticisms of his fellow workmen, it is a great satisfaction to have the work done well. Sometimes it so happens that a forging may be smaller than it ought to be, or a casting may be full of sand or blow holes. Under such circumstances the imperfect parts should be condemned and replaced by new ones. If this course were always followed there would be little trouble; but the superintendent too often decides that he will make an imperfect forging or casting do, which places the workman in a very unpleasant situation. He well knows that the work will all be done first-class, but the bad piece of material will be an eye-sore to him forever after; moreover, the superintendent, in showing the machine to his customers and friends, will naturally feel compelled to call attention to the imperfection alluded to, and apologize for its existence. The workman feels dissatisfied in fitting up that particular part, and loses a large portion of his entire interest in the whole job. There is an old maxim among machinists that runs as follows: "If I cannot do the job, I'll fix it so that no one else will." So, in order that an imperfect casting may not be used to the damage of the workman's reputation, a crack is suddenly discovered in the casting, or an important part suddenly drops off.

What puzzles the superintendent most, when his attention is called to the necessity of obtaining a new casting, is the fact that the fracture indicates a clean break, and how it could have happened is a mystery. It was this way with the wheels for the back gears of the new lathe. Suddenly it is discovered that there are half a dozen teeth missing from the large gear, and that all the fractures are fresh. How these could have been made is a mystery to the superintendent; or, if it had been done intentionally, who could have done the diabolical deed? Amidst the deepest lamentations and expressions not suggestive of any good to the man who did the damage, he starts for the office to order new gears. Of course, a new gear of the same kind, from the same pattern, will not help the matter, so far as a first-class job is concerned; he follows the superintendent, and modestly suggests that the broken gear may be used. The plan is briefly described and accepted, which is as follows:

The gear, which was 18″ in diameter, is represented in Fig. 1 of the accompanying engravings. The teeth of the gear were all turned off, and the cast iron wheel reduced in size, as shown at *B*, which represents a section of the same wheel.

A wrought iron band *C*, was made and bored so as to make a shrinking fit upon the cast iron center, as shown. This band had a small shoulder *F*, which served as a gauge in putting the band in place. The width of the cast iron center is plainly shown at *E*. A note might here be made about shrinking fits. In many shops, when it is desired to shrink a band on a cylinder, the band is bored a great deal too small in the first place. It is then heated up to a bright red, which expands it entirely too much, besides raising a scale within the ring.

After it has been placed, it is plunged into water. In such cases, if the band is not broken in contracting it is strained or stretched so as to weaken it. This is all wrong. A band can be made only tight enough to equal the limit of elasticity of the metal, or the point where it begins to stretch; therefore, it should be bored of a size which would be considered a tight driving fit. It should then be heated, only enough to allow it to slip to its place.

The heat required will not be sufficient to raise a scale, and the band will not heat up and expand the cast iron, as in the former case.

After the wrought-iron band had been shrunk upon the cast iron center, the wheel was put upon a mandrel, and the band trued up all over, after which the teeth were laid out. This was done in the following manner:

The mandrel was removed, and a piece of square iron placed in the hole for a center. After locating the center by the aid of a pair of hermaphrodite calipers, it was marked permanently with a very fine-pointed center punch. (These explicit details are not given for the benefit of the old mechanics who have been through the mill, but for the apprentice and those who may not have had such an experience for a number of years.)

When the center has been accurately located, with a very fine-pointed pair of dividers strike a line for the bottom of the tooth. The position of this line may be determined from any shape of tooth selected from teeth in gears upon other lathes in the shop, or from one designed with a single radius by either the Willis or Robinson system, both of which are well known, together with those already published in the AMERICAN MACHINIST. The gear here represented was to have 120 teeth, so I first divided the circle representing the pitch line *D*, of the gear into six equal parts, then each of those parts into two, which would be twelve equal parts in the whole circumference. Each of these parts would therefore contain ten teeth. Some mechanics with the dividers would step off the entire circumference of the wheel in dividing it up, which would increase the possibility of error. The best way is to do as I have have described, and be very careful in marking the divisions with a fine-pointed center punch.

Each of the twelve divisions may then be divided up separately, being careful to space them correctly for the number of teeth in the entire gear, as shown at *A*, at Fig. 1.

After dividing the gear, as described, each line represents the center of a tooth. The wheel was then ready for cutting, and was placed upon the mandrel of a shaping machine, as shown by Fig. 2, where *M* represents the mandrel, *G* the gear to be cut, rigidly held by tightening the screws, to prevent the table from sliding upon the crosshead *L*. The tool *I*, for cutting the gear, was filed up to a sheet-iron template, the exact shape of the tooth when finished. A gauge *K* was bolted to the table, so as to coincide with one of the marks representing the center of each tooth, after the tool *O* and gear *P* have been set by a plumb line *Q*, as shown.

The point of this gauge should be of steel, and should just clear the gear, otherwise it may be broken. First, a square nose or parting tool was used in cutting down between each tooth, after which, the finishing tool was used, for shaping and finishing.

To prevent the tool from chattering, I tapped two ¾ inch holes *J* in the machine, and inserted rods or stud bolts.

A piece of flat iron, *H N*, was then placed across the face of the gear and held in place by nuts, as shown. These nuts were tightened only sufficiently to prevent the gear from springing, and yet allow it to be rotated after slacking a nut upon the mandrel.

An apprentice boy cut the gear, after he had been assisted in starting—120 teeth in 7½ hours. Other gears required for the feed motion and back gear, for the same lathe, were laid out and cut in the same manner. The lathe was put together and has now been running several years.

It took a chip from a 5″ axle, reducing the diameter to 3¾″ at one cut, with a feed of 19 to the inch.

A prominent mechanical engineer recently examined the gears upon this lathe, and, on account of their smooth running, was firm in his belief that they were cut upon a regular gear cutter.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

JACKSON BAILEY, Vice-Prest.

LYCURGUS B. MOORE, Treas. and Sec'y

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.
F. F. HEMENWAY, Associate.

The American News Company,
Publishers' Agents, New York.

The International News Company,
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY
The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, Omaha, Neb.
The American News Company, St. Paul, Minn.
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, N. Y.
The Williamsburgh News Co., Brooklyn, E. D., N.Y.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Washington News Co., Washington, D. C.
The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.
$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.
Transient, 30c. per line, (12 lines one inch.)
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, DECEMBER 24, 1881.

CONTENTS.

PAGE.
The "Eclipse" Traction Engine..... 1
The Atlanta Cotton Exposition..... 2
A New Application of the Fontaine Principle.... 3
Burns' Improved Coffee Roaster..... 3
Details of a New Compressed Air Locomotive.... 4
To Keep Machinery from Rusting..... 4
Second Annual Meeting of the Cotton Manufacturers..... 4
The Worthington Power Pump..... 5
Letters From Practical Men—Something About Centers—Overhead Direct-Connected Engines—Tools for Slotting Machines—Inaccuracy in High Speed Indication—Strength and Elasticity of Floor Beams—Device for Taking up Lost Motion on a Lathe Screw—Shop Wrinkles—Principles Involved in Screw Propulsion....5, 6, 7
Shop Kinks. No. 24. By L. F. Lyne..... 7
Questions and Answers..... 9
Manufactures..... 9
Newly Incorporated Companies..... 9
Machinists' and Engineers' Supplies..... 10
Iron and Metal Review..... 10

The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

The Steam Engine Business.

No mechanical industry has experienced a greater impetus from the general business activity during the last year than the building of stationary steam engines. Not many months ago all the steam engine builders in this country (not including manufacturers of small power engines), whose productions were accredited as *first-class* among mechanical engineers, could be counted upon the fingers. Such, however, has been the progress of this industry, that first-class engines, both in design and workmanship, can now be procured from a score or more of establishments. Another comparatively recent feature of the business is that more engines of new design are being introduced by Western establishments than by those in the East. This is probably due to the fact that so many new enterprises requiring power are being started in the West, many of them in small and growing towns where power has never before been required. The demand for engines for electric lighting is very great. For this purpose high-speed engines are very popular, and it is a notable fact that most of the newly-starting engine building establishments are based upon the high-speed principle.

Another cause of an over-active engine trade may be found in a growing distrust of water powers in consequence of prolonged and troublesome droughts. Very few water powers can be relied upon at all seasons of the year. A few weeks of low water, and the consequent loss from the stoppage of a manufactory, in such busy times as we now enjoy, may be expected to more than counterbalance a year's saving in the difference between the cost of water and steam power. Not a few manufacturers have realized this fact within the past six months. Another source of increased demand may be noted as coming from establishments where old, shaky and wasteful engines, liable to break down any day, have been in use to the evident injury of the proprietor's business. When pressed with orders, the most conservative individual will be likely to realize the source of such a constant injury, and make a movement to remedy it.

Although the best class of engine builders are driven to their fullest capacity to fill orders, there is hardly any demand for engines of an inferior grade. Hardly any business man cares to risk the success of a new industrial enterprise upon a second or third-class engine, when one satisfying all modern requirements can be procured. The difference in first cost is not so much of a stumbling block as it was a few months ago.

The True Value of Mechanical Skill.

There is one thing particularly worthy the attention of the apprentice and the young mechanic, and that is the actual difference in the value of thoroughly-skilled and competent, and half skilled and incompetent labor. It would, on the face of it, seem that if one mechanic was capable of doing two-thirds as much work as another, that in order to do exact justice to all parties, he should receive just two-thirds as much in the way of wages. In point of fact, however, there would be no justice at all in such an arrangement.

In order to divest the matter of the wages aspect, let us suppose that two individuals enter into partnership, and that the better workman can do work representing $1,500 a year, and the poorer one two-thirds as much, or $1,000, and that they find the interest on plant, sinking fund, and incidental expenses, to be $1,200. Since it is evident that each will occupy the same amount of room and require the same tools with which to work, it is evident the $1,200, in the way of expenses, should be equally assessed, and the amount to which they would be equitably entitled, in the way of wages, would be $800 and $400, respectively. In other words, the one who does one-third more work than the other is, in strict justice, entitled to two and one-quarter times as much of what is left to divide, and which stands to them in the place of wages. Now, the matter would in no sense be changed, if instead of working for themselves they worked for a third party, and it is a consideration of this fact that leads far-sighted employers, especially in a business that calls for a large expenditure in the way of tools, etc., to look for high-priced men.

It is always apparent, that the mechanic who has given the amount of energy necessary to thoroughly comprehend and master his business, is always the one who has work and good wages without much reference to the times, and there is no reason to doubt that the difference in this respect will be more marked in the future than in the past; or, in other words, that the mechanic who, by any means whatever, fits himself to do more and better work than another, will find himself recompensed in a much greater degree than would be indicated by the extent of his superiority, and in this there will be nothing but exact justice to all parties.

There are to-day greater inducements for the young mechanic to improve and perfect himself in his trade than ever before, since the absolute value—from a business point—of skill is beginning to be fairly appreciated.

The Best Trade to Learn.

In the third annual report of the New Jersey Bureau of Labor Statistics, just published, it is shown that machinists have higher earnings than any other tradesmen, the average for machinists being $779.01 per year, against a general average of $428.58 for all the trades. Bricklayers, masons and some other tradesmen may, perhaps, receive higher wages than machinists, but they have work only a portion of the year, while good machinists can find plenty of steady work, be it summer or winter, wet or dry, hot or cold. The machinist's trade is one not likely to become overcrowded. In fact, the demand for more machinists has become chronic, and any young man of mechanical tastes cannot do better than learn that trade in a thorough manner.

Rapid Ocean Transit.

Whatever truth there may be in the rumors of projected steamship companies which contemplate the building of vessels to cross the Atlantic in about one-half the time, now occupied in the voyage, these rumors are at least of interest as exponents of thought in the direction of rapid ocean transit.

Modern thought and modern invention is largely in the direction of annihilating distance, and with the subject of quick ocean travel thoroughly agitated there is little doubt that the establishment of express steamship lines is at the most only a question of time. As one of our correspondents recently intimates, travelers would not take kindly to traveling by rail in connection with freight trains; and if it is demonstrated that considerable time can be saved in traveling express by water, there is no reasonable doubt of traveling in this way becoming popular, or in other words, there is no reason why we shall not have lines of passenger or express steamships exactly as we now have express railroad trains.

The difficulties to be overcome, however, before the speed of ocean-going steamships can be increased to the extent anticipated, are by no means trifling, or such as relate in any great degree to the question of capital. An increase of speed equal to fifty or seventy-five per cent. under existing construction calls for an immense increase of power, and probably for considerable modification of the manner of applying the power. More power—that is, to the extent that would be required to nearly double the speed—calls for additional weight of machinery and of coal, thereby partially defeating the end in view, while the hulls, which experience is showing are none too strong for present speed and power, would have to be greatly strengthened.

There is, of course, the possibility of employing different material in the construction of the machinery—as substituting steel for iron in all parts of the engine—by which means the weight may be kept down, while the power is increased, and there is the further possibility of increasing the speed, which would result in increased power with but slight addition to the weight; but largely increased boiler capacity would still be necessary—which means increased weight—and the additional weight of coal. Again, a high speed or greater number of revolutions suggests the probable need of modifications of the screw, as well as still further loss in its application.

There remains always as an economic consideration, the use of steam of much higher tension than that usually employed in the steam engine, and about which but little is known except that it has been tried from time to time without entirely satisfactory results. That is, there has been no such change in steam pressure as might have been expected had the theoretical advantages of high pressure been to any considerable extent attained.

If, however, a virtual failure, so far, for extraordinary steam pressures be conceded, it by no means demonstrates that success may not yet result from its use.

As previously intimated, the difficulties in the way of the success of rapid ocean transit may be taken as engineering rather than financial difficulties. The rates on such a line would necessarily be high, but there is every reason to believe that this consideration would be entirely outweighed by that of speed and comfort.

While, in the light of past experience, it would, perhaps, be foolish to attempt to reason that all that is claimed by the most enthusiastic of the advocates of high-speed steamship lines may not eventually be realized, it is in the same light improbable that this end is to be reached except as the result of the extended experiments of skilled engineers; but if the result is reached, it will be more than worth all the efforts made to reach it.

A steamship that will land her passengers, as is claimed, in any weather, in Liverpool in from four to four and one-half days after leaving New York or Boston, will most certainly mark a new era in steam navigation, and one of the greatest engineering advances of the century.

A New Treasurer of the Mechanical Engineers.

The Council of the American Society of Mechanical Engineers, at a special meeting, held December 4th, after the failure of every effort to induce the treasurer of the Society, Lycurgus B. Moore, to withdraw his resignation, tendered at the annual meeting, November 3d, 1881, for reasons then stated, appointed the veteran engineer, Charles W. Copeland, 24 Park Place, New York, to that position. Mr. Copeland will at once enter upon his new duties.

Reading About Mechanical Progress.

One of our active correspondents, who is very ready and accurate in detecting cause and effect, writes us as follows in a private letter:

"I am surprised that there are so many mechanics who read no mechanical paper. The missionary field is a broad one in this direction; and I am satisfied that, of all the questions pertaining to apprenticeship and successful mechanical operations in these days, when the trade secrets of a few years ago are being made public, 'To read or not to read," is the most important.

The mechanic who reads makes more improvements and commands higher wages than those who do not read. It is easy enough to select *what* to read when the inclination is present.

There was never a baser calumny expressed than the stock phrase that education puts a man above his work.—*Professor Rogers.*

The present issue of postage stamps is at the yearly rate of 954,128,440; value, $24,040,643, or an average of about two and one-half cents each.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) M. E. F., Hamilton, Ont., asks how to recover tin from scrap iron? *A.* We know of no way by which this can be done so as to pay.

(2) J. C. V., Lawrence, Mass., asks: How much coal per horse power should be burned per hour for a pair of engines 23″x48″? *A.* It is impossible to answer your question on general principles. It will depend upon the condition of the engines, the speed at which they are run, the amount of work being done, the pressure of steam carried, the condition and efficiency of the boilers, the quality of coal, whether the engines are run condensing or non-condensing, etc.

(3) A. W. S., Haverhill, Mass., asks: Will you please inform me what kind of a tram you refer to in your answer to question No. 11, in issue of Dec. 10? Also, how is the tram to be used? *A.* The use of this tram, as well as its shape, is fully described in the AMERICAN MACHINIST of Nov., 1878.

(4) D. A. R., Paris, Ohio, asks: Can you tell me how to case-harden screws up to ⅝″ in diameter? *A.* Place the screws in a cast iron box along with animal carbon: lute the cover with a mixture of fire clay and sand, and keep the whole at a red heat from one to five hours, according to their size and the depth to which you wish to harden them. Remove the cover, and empty the contents into a trough of water. For the animal carbon use horns and hoofs of animals, and pieces of leather.

(5) A. L., Malden, Mass., asks: What would be the chances of a middle-aged machinist and engineer at the South, and to what part of the South would it be best to go? *A.* Ordinarily the chances are about the same as in Massachusetts. In exceptional cases a man may do better for about eight months in the year on a sugar plantation, in Louisiana, for instance, but he will lose enough the other four months to even it. As a whole, we think the inducements held out to a mechanic to go South are not exceptionally good. We answer you the same as we should answer a man in Georgia or other Southern State with reference to going to Massachusetts.

(6) W., Philadelphia, Pa., writes: 1. We have a horizontal slide-valve engine: cylinder, 9″x24″; steam ports, 1″x6″; steam pipe, 2″. The engine runs at 80 revolutions. Can we, by any alterations, get 30 or 35 horse power from this engine? *A.* That will depend upon the general construction of the engine. If it is in all its parts strong enough; if the bearing surfaces are ample, and if it is well balanced, by increasing the size of steam pipe to 3″, running at 130 revolutions, and carrying from 90 to 100 pounds of steam, you may succeed. 2. We also want a new governor. Which do you think is the best? *A.* There are many good governors in the market. For obvious reasons we cannot recommend any particular one as being better than another, in our reading columns. 3. Who makes chilled boxes for wagon axles? *A.* We do not know of any one who makes them. If any of our readers do, we shall be glad to hear from them.

(7) E. K. K., Lonsdale, Pa., writes: There is a new boiler in a flouring mill, 42″ diameter, with 36,3″ tubes, each 15 feet in length, and rated at 40 horse power. The grates are 4 feet 11″ by 3 feet 6″. There is a good draft, and 12 pounds of coal per hour per square foot of grate is burned. The engine is 10½″x24″, and runs 80 revolutions, cutting off at ¾ stroke. Engine in thorough repair. Boiler will only make steam for one run of stone, which requires 30 pounds pressure. For two runs it requires 40 pounds. I propose to run the engine 50 revolutions, instead of 80 as at present. Can you give me any advice, also tell me what the horse power of the engine is? *A.* According to your statement you are burning 288 pounds of coal per hour, and doing, we should judge, not more than 15 horse power of work: hence you are burning 18 pounds of coal per horse power per hour, or three times as much as you ought to burn with such an engine as you describe. There is probably something wrong about the engine or boiler setting. With reference to reducing the speed of the engine, if you propose to run one run of stone, you would probably get along with a *little less coal* by reducing the speed as you suggest; but if you propose to operate two runs, we should not reduce the speed. We think, however, that you may meet with trouble by reducing the speed. An engine driving a flouring mill should govern very finely, and by running slower the engine will not govern so well as it does now: also the fly-wheel of the engine should have a speed sufficiently high to prevent backlash of stones. All these things should be taken into consideration before deciding to reduce the speed. The engine as run is about 30 horse power, that is assuming it to be doing the amount of work an engine of this size, and running at a speed of 80 revolutions, would do with good economy and regulation.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

For Sale—1 Iron Planer, Planes 8½ ft. long, 34 in. wide, 30 in. high, to be delivered in Jan. $550.00. 1 15 in. Engine Lathe, 7½ ft. bed, Wright's make, Screw Cutting, Rod feed, with counter complete, for immediate delivery, price $250.00. Both machines, in good order, are sold to be replaced with heavier. Address, Concord Axle Co., Fisherville, N.H.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

James W. See, Consulting Engineer, Hamilton, O.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Useful Information for Steam Users." A 100 page *Illustrated Pamphlet*. Contains interesting data on the care and management of the steam engine and boiler, and rules for engineers and firemen. The engineers of every well regulated establishment should have this work. Sent by mail on receipt of twenty-five cents in postage stamps. The J. N. Mills Publishing Co., 165 Broadway, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. Just the thing for a Holiday gift. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

MANUFACTURES.

George E. Forbes will soon erect a three-set woolen mill at East Brookfield, Mass.

The Illinois Iron and Bolt Company, Carpenterville, Ill., are building an addition to their foundry 180x70 feet, and three stories high.

The Pawtucket, R. I., Manufacturing Company have commenced work on a building 152x120 feet, to be used for the manufacture of bolts.

The Dangler Vapor Stove Company, Cleveland, Ohio, are pressed with orders for their new coal oil torch for foundry and machine shop use.

The Union Iron and Steel Company, Chicago, will make their new shop entirely fire-proof, replacing wooden posts, stays and girders with iron.

The Allen Paper Car Wheel Company, Pullman, Ill., and Hudson, N. Y., are receiving an invoice of 10,000 steel tires from the works of Fried Krupp.

The Youngstown, Ohio, Car Works are agitating the question of erecting additional buildings to be used in the manufacture of passenger coaches.

The Fall Mountain Paper Company, Bellows Falls, Vt., is setting a new steel boiler manufactured by the Whittier Machine Co., with the Jarvis setting.

The glass blowers at one establishment in Zanesville, Ohio, have agreed to pay $4 each if any profanity is noted while at work between Dec. 1 and Christmas.

The National Electric Signal Company, located in Boston, Mass., will change their location to Nashua, N. H., if they are exempted from paying taxes for ten years.

Munson Bros., Utica, N. Y., are putting in new tools from Pratt & Whitney, and other manufacturers, to be used in manufacturing grist mill and pulp mill machinery.

The Hartford Compressed-Air Pump Company, Hartford, Conn., have recently shipped a large pump to Barcelona, Spain. This makes three shipped to the same parties.

The Betts Machine Company, Wilmington, Del., devote one of their shops entirely to the manufacture of machinist's gauges, which they guarantee to the ten-thousandth part of an inch.

The Co-operative Stove Foundry, Troy, N.Y., have awarded the contract for extensive buildings to cost $25,000, in addition to their large works in that city. They will be completed the first of March.

The Oak Point Mining Company, Charleston, S. C., are rebuilding their phosphate works, recently destroyed by fire. Their boilers will be set with the Jarvis furnace for burning a cheap quality of coal.

Macfarren, Levy & Co. have just completed a three story brick building at Chicago, Ill., in which to carry on the manufacture of special and standard machine tools, including gauges and appliances for special work.

The American Furniture Gazette says that Cincinnati furniture manufactures are all busy, and that they report trade is lasting longer this season than ever before in the history of that city. The demand is such that every manufacturer will find it necessary to run to his fullest capacity during the Winter, as there are absolutely no stocks on hand, and many orders yet remain unfilled.

The National Tube Works Company, McKeesport, Pa., are about to put in four additional Siemens-Martin double gas furnaces. This will make a total of 15 double furnaces of this kind used in that establishment.

The Brown & Sharpe Manufacturing Company, Providence, R. I., are increasing their capacity for turning out machinery and tools. They are now employing 475 men. The moulding room of the new foundry, 265x57 feet, is full of work.

Edgerton & Davis, Palmer, Mass., having completed the enlargement of their machine shop, will at once commence to enlarge their foundry. They are building hat machinery, gas retorts, and doing a general jobbing business, including cotton mill repairs.

W. D. Hartupee, of Pittsburgh, is building a very fine high speed engine for the Union Steel Company, of Chicago. It is 18-inch diameter and 24-inch stroke, with all the latest improvements. Fourteen other engines are under contract by this firm, which will make things lively at the shop this winter.—*National Labor Tribune.*

The Shenandoah Valley Railroad will establish shops at the Shenandoah Iron Works, just on the line of Page and Rockingham Counties, at Milnes' Iron Works. The foundations for the requisite buildings are now being laid. Luray might have secured them, if that county had pursued a different course in reference to its county subscription.—*Staunton (Va.) Spectator.*

The Akron Iron Company has entered into a contract with the Cuyahoga Works, of Cleveland, for a mammoth engine, which will be the largest in the city. The cylinder of the new engine will be 30 inches in diameter, with a 54-inch stroke. The engine will be 500 horse power. The fly wheel will weigh 35 tons. The engine is to be ready in three months, and will cost, together with the foundation, $10,000.—*Akron Beacon.*

M. C. Bullock, 80 to 88 Market Street, Chicago, employs 85 men in building the Straight Line Engine designed by Prof. Sweet, also all kinds of mining machinery. He has a well-appointed shop, but will build new and larger shops in the Spring. He will erect a machine shop, a boiler shop, a foundry and a pattern shop. The superintendent is Edgar Penney, who lately left the Corliss Steam Engine Works to accept this position.

A. L. Crocker, whose starting in the machine and foundry business at Minneapolis, Minn., we recently noticed, has associated a partner, the firm being Crocker & Pell. They will do a general engineering business, manufacturing extensively as well as handling supplies, etc. Mr. Crocker has just returned home from New York and the East, where he has been transacting business looking to the thorough establishment of their enterprise.

The Southwark Foundry and Machine Company, Philadelphia, Pa., have recently erected new buildings to increase their facilities for manufacturing the Porter-Allen High Speed Engine. Owing to the fact that American tool builders could not contract to deliver for some months, the company have been obliged to put in a number of English tools. They are at present building a 2,000 horse power engine for the Lackawana Iron and Coal Company, and a large number for different electric light companies.

The Straight Line Engine Company, Syracuse, N. Y., are manufacturing a measuring instrument, or micrometer caliper, to measure up to 4″, and so made that it may be held in an ordinary vise without danger of distortion, or it may be used in the hand to measure a piece on the planer or milling machine, or to caliper a shaft while in the lathe. It is fitted with Prof. Sweet's device for correcting the pitch of the screw, with friction for controlling the intensity of contact, and is afforded at a very reasonable price.

E. Gould & Eberhardt, machine tool builders, of Newark, N. J., are working 100 men on their line of machine tools. While they have no work done on the piece-work system, they have established a plan of paying a bonus in proportion to efficiency, which enables them to keep the best skilled workmen, and enables such men to largely increase their regular pay. The firm has within the past two years not only added considerably to the list of patterns, but has made extensive changes in general patterns, in a direction suggested by past experience.

Newly Incorporated Companies.

MASSACHUSETTS.

Wheeler Reflector Company, Boston. William Wheeler, Prest.; Elbert Wheeler, Treas. Capital, $100,000. For the manufacture, sale and use of reflectors, and other appliances for lighting buildings, streets and other places.

E. Howard Watch and Clock Company, Boston. Edward Howard, Prest; Chas. J. Hayden, Treas. Capital, $250,000. For the manufacture of watches and clocks.

Ryder Grate Company, Boston. Jas. J. Walworth, Prest.; Arthur C. Walworth, Treas. Capital, $15,000. For the manufacture of grates, grate bars and other metalic products.

Huntoon Manufacturing Company, Boston. Chas. F. Brown, Prest.; Sam'l L. Powers, Treas. Capital, $30,000. For the manufacture and sale of the Huntoon patent window blind operator and lock.

Morgan Spring Company, Worcester. Chas. H. Morgan, Prest; Francis H. Morgan, Treas. Capital, $10,000. For the manufacture of wire springs.

Boston and Winthrop Railroad Company, Winthrop. John H. Buttrick, Sam'l Ingalls, C. A. Parks, N. K. Baker, S. W. Hale, Geo. F. Baker, E. D. Goodrich and John Lowell, Jr., Directors. Capital, $10,000. For the construction, maintenance and operation of a railroad, commencing near the Pleasant Street station of the Boston, Winthrop and Point Shirley Railroad, thence along the southerly side of the town of Winthrop to the Ocean Spray station of the Boston, Winthrop and Point Shirley Railroad, all in the town of Winthrop, county of Suffolk. Length 1¾ miles. Gauge three feet.

NEW JERSEY.

Elizabeth City Contracting Company, Elizabeth; W. G. Oakman, A. H. Calef, C. E. Satterlee, and others, corporators; Capital, $2,000,000. To construct and equip railroads, bridges, elevators, etc.

NEW YORK.

The Edison Duplicating Press Company, New York; Eugene H. Hinton, Henry S. Morse and Wm. L. Hubbard, corporators; Capital, $50,000. To manufacture and sell said press, or any other machines that may be connected therewith.

United States Vulcanizing Wood and Lumber Company, New York; Wm. Dowd, L. B. Faulkner, R. La Forte, Wm. H. Wickham, E. N. Dickerson, Jr., Thos. F. Rowland, Herman Dowd, Henry Steers, H. H. Cook, Myron P. Bush, Benj. W. Wooster, Henry R. Pierson and Oscar L. Hascy, corporators; Capital, $3,000,000. To prepare and treat lumber, and manufacture articles therefrom.

John Trageser Steam Copper Works, New York; John Trageser, William C. Trageser, Albert F. Trageser and Augusta Trageser, corporators; Capital, $125,000. To manufacture, purchase and sell copper and other metals, wares and merchandise.

Santa Martha Railroad Company; Robert A. Joy, Manuel Julian de Mier, Francisco J. Cisneros, Joaquin de Mier, Wm. M. Hoes, Thos. H. Messenger, Allan Hay, Fernando Parnaya, Fred'k Ansoategui, Matthias Nichol and Henry Patteson, corporators; Capital, $2,500,000. To construct, maintain and operate a railroad in the United States of Columbia, South America.

Gouverneur Marble Company, Gouverneur; Jno. N. Baxter, E. H. Sanford, E. G. Baxter, and others, corporators; Capital, $200,000. To work stone quarries, and manufacture the products thereof, in the County of St. Lawrence.

Greene Knitting Company, Amsterdam; Jno. R. Warwick, Jane M. Greene, James Voorhees, and others, corporators; Capital, $100,000. To manufacture and sell knit goods.

New York and New Jersey Car Starter Company, New York; H. A. Newell, Richard G Phelps, E. J. Burritt, Wm. D. Nichols, Nathan Guilford, Charles L. Anderson and P. B. Shaw, corporators; Capital, $100,000. To manufacture and sell Hill's Car Starter.

Standard Manufacturing Company, New York; Chas. K. Deutsch, Abram Deutsch and Chas. D. Haskins, corporators; Capital, $50,000. To manufacture and ornament gas and oil fixtures, lamps, bronzes and brass goods and wares, and the sale thereof.

Rochester and Pittsburgh Railroad Company. Directors: Walston H. Brown, F. A. Brown, Aug. Kinitze, A. L. Hopkins, Henry K. Southwick, James Calleras, Geo. F. Stone, Wheeler H. Peckham, Nelson Robinson, F. D. Tappan, R. T. Wilson, William M. Shaffner and R. F. Webb. Capital, $10,000,000. New company formed by merger and consolidation of Rochester & Pittsburgh R. R Co., Rochester & Charlotte R. R. Co., Buffalo, Rochester & Pittsburgh R. R. Co., Great Valley & Bradford R. R. Co., Bradford & State Line R. R. Co. and the Pittsburgh & New York R. R. Co.

"Hop-O-Nose" Knitting Company, Limited, Catskill; Wm. H. H. Schofield, Thos. E. Ferrier, Benj. Howland, and others, corporators; Capital, $25,000. To manufacture cloths, hosiery and other goods, composed wholly or in part of wool, cotton or other materials.

The Syracuse and Ontario Railway Company. Directors: A. C. Belden, R. N. Gere, J. F, Wilkinson, Daniel Pratt, Wm. T. Hamilton, Geo. F. Comstock, Jas. J. Belden, Thos. Molloy, E. B. Alvoord, Jno. W. Barker, A. H. Green, Harvey Stewart and Thos. Gale. Capital, $400,000. To construct, maintain and operate a railroad, commencing at a point of intersection with the Syracuse, Chenango and New York Railroad in the city of Syracuse, thence on easterly side of Seneca and Oswego Rivers, through the village of Phoenix, to a point in the town of Volney. Length of road 23 miles.

Wellsville and Fillmore Railroad Company. Directors: Jno. J. S. Lee, Isaac W. Fassett, Jas. MacKerd, C. A. Farnum, H. K. Opp, Orville P. Taylor, Wm. H. Baldwin, D. Clark, Edw'd J. Farnum, Wm. Beever, Wm. R. McEwen, Sam'l F. Hawks and L. S. Anderson. Capital, $200,000. To construct, maintain and operate a railroad, commencing in the village of Wellsville, Allegany County, running thence by most direct and feasible route through the towns of Wellsville, Scio, Amity, Angelica, Belfast, Canadea and Hume, terminating at or near the village of Fillmore. Length of road about 30 miles.

ILLINOIS.

Monitor Yarn Manufacturing Company, Chicago; John Collins, Edwin F. Rowland and Charles L. Arnold, corporators; Capital, $18,000. To manufacture and sell woolens, woolen yarns and knit goods.

North Pier Foundry Company, Chicago; James W. Reedy, P. H. Meehan and Jno. H. Jalling, corporators; Capital, $6,000. For manufacturing and foundry business.

Machinists' and Engineers' Supplies.

NEW YORK, Dec. 8, 1881.

The Brass Manufacturers held a meeting recently, and agreed upon an advance in prices. There has also been an advance in the price of wrought iron goods. Quotations, as a rule, are furnished only for immediate acceptance.

Iron and Metal Review.

The demand for Pig Iron continues active, but the supply of favorite brands is limited.

We quote foundry No. 1. at $25 to $26.50; Foundry No. 2 at $23 to $24; Gray Forge, $22.50 to $23. The sales of Foreign Iron are limited on account of the high prices. We quote Gartscherrie at $25 to $26; Coltness, $26 to $26.50; Glengarnock, $24.50 to $25; Carnbroe, $24 to $24.50; Eglinton, $23.

No changes in Iron, Steel and Old Rails.

The demand for copper is not as active as last week, but is firm at 19¾ c. to 19⅞ c. for Lake Superior. Straits Tin, 23⅛c. to 23¾c.: Australian and Billiton about the same. Lead, 5c. to 5¼; Spelter, Western, 5⅞c. to 6c. Antimony, 14¼c. to 14½c. for Cookson; American Antimony, 13c.

WANTED

Wanted—Parties with capital and tools to manufacture my improved Oscillating Engine, Pat. Feb. 3d, 1880 The cheapest engine built. J. F. Kingsley, Sayre, Bradford Co., Pa.

A machinist with best references wishes a situation as foreman or superintendent. Address Box 702, Lowell, Mass.

Wanted—A first-class Mechanical Draughtsman. Enquire 153 Cedar St., New York.

Wanted—By a man of thorough experience, a situation as superintendent of Iron or Machine works. Address L. M., AMERICAN MACHINIST, 96 Fulton St., N. Y.

Wanted—A Pattern maker accustomed to work up small inventions, one that is experienced on both wood and metal preferred. Address "C," AMERICAN MACHINIST.

Wanted—An Engine Lathe to swing about 48 inches, 16 feet or longer. Must be in good order. Clapp & Jones Mfg. Co., Hudson, N. Y.

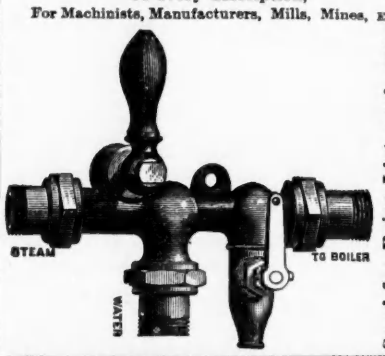
Wanted—A competent machinist as foreman of a machine shop. One that has held such positions and fully understands all the details of a general shop can find a good position by addressing Box 2, AMERICAN MACHINIST.

Valuable Manufacturing Property.

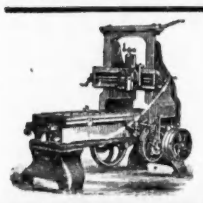
For sale or to lease, the most convenient property for the manufacture of heavy Castings, Machinery, Steam Engines, Locomotives, etc., in New England, situated at Thamesville, City of Norwich, Connecticut, with water front and wharf on one side, and Railroad (with side track) on the other, comprising on one lot 200x380 feet, **Machine Shop,** 60x200 feet—with addition for Engine Room, Boilers and Blacksmith Shop—engine of Corliss make, 150 H. P., in perfect order; **Foundry,** 80x100; **Pattern Shops** and **Storage Buildings,** 50x100; all **substantial brick buildings,** provided with Cranes, Ovens, Flasks, and all things needed for the convenient and economical prosecution of business. Sheds for the storage of coal, sand, iron and castings are connected therewith and conveniently arranged for business, receiving all material from vessel or railroad to be moved by a portable railroad to its destination. The Machine Shop is in perfect order, provided with machinery for the transmission of power to other shops in the vicinity, is heated by the exhaust steam from engine and well lighted. An adjoining lot, 200x580, can be had if required, and also some 20 tenement houses near by, at less than cost of building. Possession can be given at once. For prices and terms apply to or address

THEODORE RAYMOND, Norwich, Conn.

COOKE & CO., (Formerly Cooke & Beggs),
6 Cortlandt St., New York.
Agents for
The Keystone Injector,
(The Simplest Known Boiler Feeder,)
And Dealers in
MACHINERY AND SUPPLIES
Of every description,
For Machinists, Manufacturers, Mills, Mines, Etc



Send for Price List, and state that you saw this advertisement in this Paper.



WHITCOMB MF'G CO.
Formerly C. Whitcomb & Co.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.
IRON PLANERS
A Specialty.

VOLNEY W. MASON & CO.
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

AMOR & THOMPSON,
168 Centre St., New York City.
Manufacturers of
HAND, BACK GEARED, FOOT & POWER

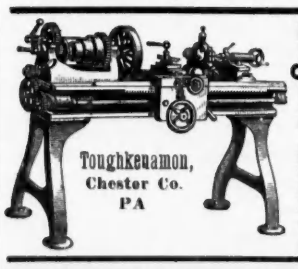
LATHES,
Slide Rests, Chucks, etc. These Lathes are built with Steel Conical Bearings, hardened and ground to a nicety, adjustable compound back centres, to take up wear, and are well adapted for brass and chandelier work. Electric Light and Telephone manufacturers.

Pattern and Brand Letters
VANDERBURGH, WELLS & CO.
Cor. Fulton & Dutch Sts., New York.

D. H. TUTTLE, 21 BEEKMAN ST. NEW YORK
Engraver on Wood
MECHANICAL WORK A SPECIALTY

ECLIPSE
PORTABLE AND TRACTION
ENGINES.
Stationary Engines,
Iron and Steel Boilers,
Portable Circular Saw Mills.
Threshers and Separators.

Send for Catalogue and say where you saw this.
FRICK & CO.
Waynesboro, Franklin Co., Pa.



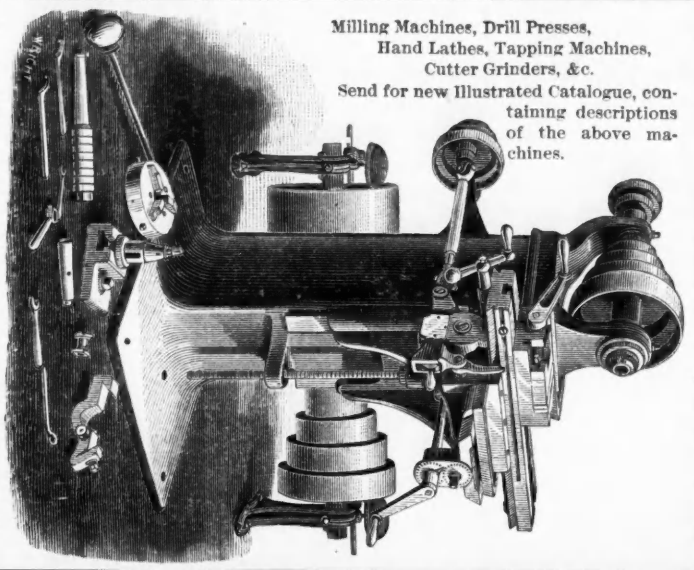
S. ASHTON HAND,
MAKER OF
FIRST-CLASS
Engine Lathes

BRADLEY'S CUSHIONED HAMMER
BRADLEY & COMPANY SYRACUSE, N.Y.

BOYD ELIOT,
Mechanical Engineer,
Expert in U. S. Courts.
Solicitor of Patents.
Offices, 40 & 41 Astor House,
NEW YORK.
American & Foreign Patents solicited, bought and sold.

EUGENE N. ELIOT,
COUNSELLOR AT LAW
IN THE
State and U. S. Courts,
Offices, 40 & 41 Astor House,
NEW YORK.

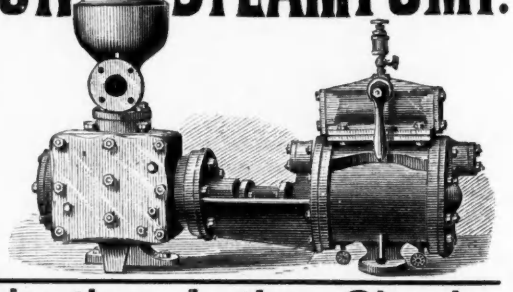
Milling Machines, Drill Presses,
Hand Lathes, Tapping Machines,
Cutter Grinders, &c.
Send for new Illustrated Catalogue, containing descriptions of the above machines.



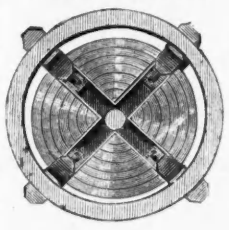
No. 2 Power Milling Machine. Price, as shown in cut, $400.00.
Office and Works, 139-143 Centre St., New York.

E. E. CARVIN & CO.
MANUFACTURERS OF
Machinists' Tools.

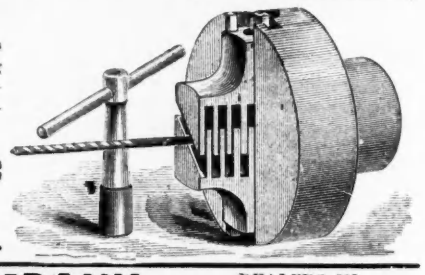
THE CAMERON STEAM PUMP.
Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
STEAM PUMP WORKS,
Foot of East 23d Street, New York.



Westcott's Combination Lathe Chucks,
Both Scroll and Geared.



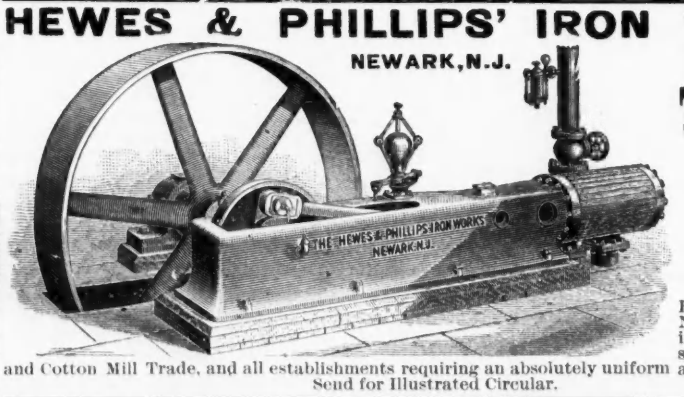
Greater capacity. Jaws reversible. No projecting screws in the rim. Movements independent, universal and eccentric.



Send for circulars.
Oneida Steam Engine and Foundry Co.
ONEIDA, N. Y.

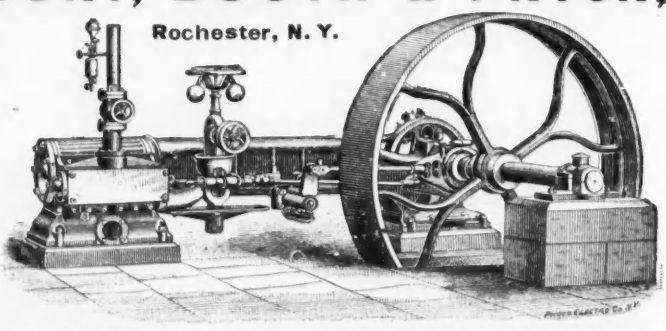
H. PRENTISS & COMPANY,
No. 42 Dey Street, New York.
P. O. BOX 3362.
DEALERS IN
MACHINISTS', MANUFACTURERS' AND RAILWAY
Tools & Supplies.

HEWES & PHILLIPS' IRON WORKS,
NEWARK, N.J.
Manufacturers of
The Allen Patent High-Speed Engine.

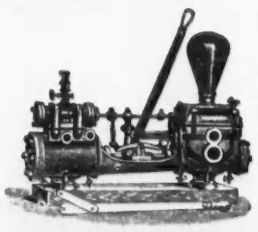


Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power
Send for Illustrated Circular.

WOODBURY, BOOTH & PRYOR,
Manufacturers of
Automatic Cut-Off,
Fixed Cut-Off,
and Slide Valve
STEAM ENGINES,
Tubular Boilers.
Rochester, N. Y.

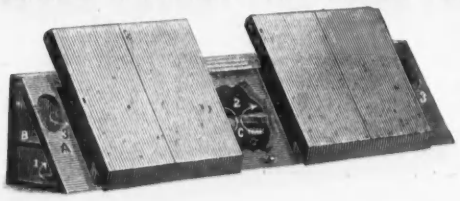


Knowles' Improved Steam Pumps,



THE STANDARD!
Steam Pumps for Every Possible Service.
SEND FOR ILLUSTRATED CATALOGUE.
KNOWLES STEAM PUMP WORKS,
86 Liberty Street, NEW YORK. | *44 Washington Street,* BOSTON.

JONES' PATENT FIRE-JAMB PLATES & BOILER SETTING.



Furnish permanent and perfect protection to the boiler front and supply heated air at the bridge wall to aid in combustion of gases.
Ask your Boiler Maker for it.
Manufactured by
Cohoes Iron Foundry and Machine Co.
COHOES, N. Y.

One 30 in. Screw Cutting Lathe,
20 FEET SHEARS.
ONE HEAVY DRILL, Second-Hand.
On Hand for immediate delivery.
BETTS MACHINE CO., WILMINGTON, DEL.